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[OFFICIAL NOTICE.]

Annual Meeting, New England Association of Gas Engineers.

LYNN, MASS., January 9, 1892.

The next annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, Feb. 17 and 18, and will be called to order at 10 o'clock, Wednesday morning, the 17th.

Persons eligible for active or associate membership can obtain application blanks from the Secretary.

Questions for the Question-Box will be published in advance if sent to the Secretary in advance. A list of papers will be given later.

C. F. PRICHARD, Sec. & Treas.

BRIEFLY TOLD.

THE FIRST OF THE ANNUAL MEETINGS.—If anything out of the commonplaces were needed to keep in mind the fact that 1892 is well under way, a glance at the above notice would be all-sufficient. The bells that tolled the death knell of '91, and that, after the fashion of bells in general, almost in the same strokes rang out a brassy welcome to '92, have only ceased their clanging when we find ourselves confronted with Secretary Prichard's initial announcement respecting the 22d annual meeting of the parent Association of the country. Having completed its 21st year, the Association makes its first bow as a full fledged adult, nor does its increase in age carry any sign of a decrease in vigor, activity or progress. On the contrary, it shows unmistakably the signs that mark expansion and extension—a broadening of views, an amplification of scope. The members this year ought to assemble in Boston under the brightest of auspices, for the past twelvemonth has been a continuous record of progress in their business. Greater output has rewarded their attention, and better than average dividend returns on their investments have been the portions of the shareholders. Not that these increased returns were gained at the undue expense of the consumers, but rather to the systematic plans of plant improvement devised and carried out successfully by the engineers and superintendents. Detail has been watched more carefully; trifles that were have been worked up into things of moment that are; and these things have naturally redounded to the credit of the engineer and to the profit of the proprietor. So we may confidently look forward to a pleasant and profitable gathering at Young's, next month, when the Sage of Cambridge, Mr. Horace A. Allyn, will order the calling of the roll. It must be borne in mind, however, that neither congratulations nor self-complacency will suffice to cause the meeting itself to be the equal of those that preceded it. Even as the results of attention to detail, which as noted above brought golden profit to the Eastern managers in the past year, were not secured without diligent work, so must it be with the Association. And it is somewhat regrettable that so large a proportion of the membership fails to contribute something towards its proceedings in the shape of papers. The writing of a paper seems to many to be a very arduous task, but it is not so in reality. Given a subject—and these ought to be and are, in the operation of a gas works, as numerous as the troubles incident to their management—there is not a man on the New England's membership roll who could not write thereon a paper that would be brimful of interest and value. Bring on your papers, then; and so keep the New England Association in its accustomed place in the procession.

MR. TERRY, ON "THE FIELD OF ELECTRICITY."—Elsewhere (page 82) we reprint an article by Mr. F. S. Terry, from the Chicago *Daily News*, in which the writer attempts to review the course of the electrical industry for the past year, and if those interested in the supply of the elusive and illusive current are satisfied with this particular champion's presentation of its merits and virtues we can only say that they are easily satisfied. The gentleman starts out as an apologist, being impelled to remark that "the progress of business" was not "as great as was hoped for, nor as the earlier months gave promise of." However, Mr. Terry finds consolation or excuse for this state of affairs in the

assertion that "last year electricity has not been used as much as heretofore in booming the growth of many of our western towns;" which circumstance might be taken by a disinterested observer as indicating that even the boomers, who are never careful as to the accuracy of their statements when assisting a "boom," have discovered that electric lighting is not all that their fancy painted it as a booming aid—in fact, in many instances, it has proved a veritable boomerang. Again, Mr. Terry finds that much of the desuetude in this year's electric lighting business is due to "more or less irresponsible" persons that "have gone into the business." The fact is Mr. Terry as was wisely remarked by a man, whose keen insight into human nature will remain unquestioned to the end of civilization, that while you may fool some of the people all the time, and all of the people part of the time, it is nevertheless a certainty that you cannot fool all the people for all time. Mr. Terry, of course, has his little fling at the unhealthfulness of gas and at its inherent danger as a fire begetter, and also brings the match out from its safe, as was to be expected; but he fails to say that people prefer to use gas because they find it better suits their needs, both in the items of economy and efficiency of lighting service. He also fails to say that a well piped gas service is immeasurably safer than a well wired electric lighting service; but, of course, he was making it strong for the wretched little bulb, whose average life is nothing but a continual strife with decay, that sets in at the very moment of its quickening. A hypocritical life it is, too. Reviewers like Mr. Terry ought to be relegated to the typwriter's desk.

OUR ANNUAL REMINDERS.—Since the opening of the New Year we have been in receipt of many reminders that '92 is very much in evidence, and many of these reminders are artistic as well as useful. In the first place come the Meter Company annuals, handsome specimens of which are at hand from the American Meter Company, Messrs. Helme McIlhenny, D. McDonald & Co., J. J. Griffin & Co., and Harris, Bros. & Co. Perhaps the last named is the most artistic in binding make-up of the lot, yet all are well put together and contain much valuable information between their covers. A new-comer in the field is Jas. Gardner, Jr., of Pittsburgh, whose time reckoner consists of a very handsome vest-pocket note and memorandum book, which we venture to say will be used to the very last page by those who received it. Next in order come the calendars, specimens of which have been received from Messrs. Jas. R. Floyd & Sons, D. McDonald & Co., the Keystone Meter Company, and the National Gas and Water Company, of Chicago. The Floyd calendars are very handsome ones, indeed, and reflect great credit on the designer. The cut and printing work, in art black and white, is a marvel of skill. The National Company's calender (a 12-sheet pile, of neat parallelogram shape) is an expensive and well printed affair. Each sheet carries a handsome picture, in colored inks, of a different building in the group of structures that will hold the wealth of all countries at the coming World's Fair. Last, we have catalogues from the Whittier Elevator Company and from the Loomis Gas Machinery Company, of Hartford. The Loomis catalogue, which is very bulky, is as fine a sample of cut work printing as one could wish to see.

NOTES.—The proprietors of the Bath (Me.) Gas and Electric Company have closed a contract with the Davis & Farnum Mfg. Company, under which the latter will erect a new gasholder (50 ft. by 18 ft.) in the tank that held a holder that outlived its usefulness; also a new 20-inch hydraulic main, a 6-inch Wilbraham rotary exhauster and engine, with bye-pass and governor, and an 8-inch Connelly street governor, and such pipes and specials necessary to put the works in first-class condition.——At the annual election of the Williamsport (Pa.) Gas Company the following officers were chosen: President, Hon. J. M. Gazzam; Sec., Treas. and Supt., C. A. Byers; Asst. Supt., M. J. Winters; Solicitor, John G. Reading, Jr.

The Market for Gas Securities.

Consolidated is slightly lower. The opening price to-day (Friday) was 102½ to 103¼, and the upward movement in the shares is likely at an end for the present. Other city shares show no change, unless it be in Standard, which is somewhat firmer in both divisions—common and preferred. Brooklyn shares are strong and active, the notable gains having been made in Fulton-Municipal, Nassau and Brooklyn. Citizens was the exception, which fell off about three quarters of a point. Baltimore Consolidated is somewhat stronger, at 46¾ to 47, and we have no hesitation in saying that these shares are a purchase for an investment. Chicago gas was up and down as usual, but the net result for the week is a gain of 2¼ points. At the annual election the only change in the management was the naming of "Tony" Brady to the Directorate, vice W. H. Gebhard, resigned.

[Prepared for the JOURNAL.]

The Condensation of Steam.

By MR. ALLEN S. MILLER, of the Omaha (Neb.) Gas Manufacturing Company.

I looked anxiously in your last issue for some comment on the article published in the JOURNAL of Dec. 28,* entitled "The Condensation of Steam." Failing to find it, I hope that the following information may serve in a measure to enlighten your readers.

Rankine and Clausius discovered independently that the specific heat of steam at ordinary temperatures is negative. It is also known that above 978° F. it is positive. This means that if saturated steam is allowed to expand in a non-conducting vessel a portion of it will condense, giving up the heat to the remainder of the steam, thus maintaining the temperature corresponding to saturation. If it be compressed in such a vessel, heat must be abstracted if the temperature and pressure continually correspond to saturation. The point corresponding to a temperature of 978° F. is that beyond which saturated steam cannot be compressed, as referred to by the *Engineer*.

It is a mistake to suppose that steam is condensed by wiredrawing. It has been shown, both experimentally and analytically, that steam is superheated by being wiredrawn. The reason that there is more condensation in small pipes than in large is because the radiating surface is so much greater, proportionately. The area of the cross-section of a pipe varies with the square of the diameter, while the circumference varies only as the diameter.

Confirmation of the foregoing may be found in Rankine's Steam Engine; Vol. I. Thomson's Math. and Phys. Papers; Clausius' Theory of Heat; Rankine's Mech. Soc. Papers, or in the works of any recognized authority on this subject.

[Concluded from page 7, issue of Jan. 4th, 1892.]

Some Practical Disadvantages Incidental to the Generation and Distribution of Electricity to Consumers.

[Contributed to the London *Journal*, by Mr. NORTON H. HUMPHRYS.]

The difficulty in the matter of storage, referred to at the close of the preceding article, has led electricians to give more attention to the matter of variation in demand—not only as regards the individual months or weeks throughout the cycle of the year, but also, and more especially, from minute to minute and from hour to hour through the entire day—than has ever been found necessary in the case of coal gas. Gas engineers have not entirely neglected the subject. The advantage of additional day or summer consumption as a factor in increasing the proportion between the maximum daily make and that for the year (thus enabling a larger revenue to be earned from a given quantity of plant as representing a definite expenditure of capital), has been repeatedly pointed out and discussed. The facts that an increased consumption per consumer means a larger supply effected through the existing distribution plant, and that an addition to the number of consumers per mile main contributes towards the same desirable result, have not been overlooked. It is known that they are concerned to a great extent in the gradual reductions in the price of gas which have prevailed from the first; bringing the present selling price to not more than one-fourth of that which was found to be necessary in the early days. But in the case of electricity, they assume very much more important proportions; and they may even extend so far as to determine the soundness of the concern, or otherwise, from a business point of view. It becomes the all-engrossing question whether electricity can be supplied, agreeably to local circumstances, at a price sufficiently moderate to secure a fair share of custom, and at the same time high enough to allow a just dividend for the shareholders after meeting the working expenses. Mr. Crompton has introduced a convenient expression for dealing with these and similar problems, in what he calls the "load factor."

This expression may be defined as an indication of the work actually done by any given plant, as compared with that which it is capable of doing; and it may be applied in different ways. It may be stated as a fraction or percentage, showing the proportion existing between the output and the maximum capability, as regards any desired period of time, such as an hour, a day, a week, a month, or a year. Or, instead of the maximum capability, the highest duty actually accomplished may be taken as the denominator. Thus a comparison may be effected between an hour's consumption, in the morning and evening respectively, for the same day; between that for a day in June and for a day

* See Vol. LV., No. 26, p. 922.

in December; or in any other way that is likely to yield interesting results.

Let us apply this question of the load factor to the gas industry. Suppose we have a gas works having a maximum production of a million cubic feet per 24 hours. Its annual capability may be taken, for our purpose, as 360 millions. But, as a matter of fact, the million cubic feet would represent a day's consumption at the darkest period of the year. The actual daily output in such a works would range from about 300,000 cubic feet at midsummer, to 1,000,000 cubic feet at Christmas; and the quantity made and supplied per annum would be about 240 millions, or only two-thirds of the capability. The load factor for the year is therefore 240 ÷ 360.66 per cent., or 0.66 as we may chose to put it. Again, the capability of the works, for a month of 30 days, would be 30 million cubic feet. But in June, the output would only be about 10 millions; giving a load factor of 0.33. In a gas works where the demand shows a steady increase, it is well to keep somewhat in advance of the requirements; and so perhaps the actual maximum daily consumption may be only 800,000 or 900,000 cubic feet. On the other hand, to meet the consumption above indicated, plant equal to the production of 1,200,000 cubic feet per 24 hours may have been provided. In most gas works the load factor for the year, as shown by the actual make compared with the capability of the works, is something like 50 per cent.; and that for the lightest month of the year is not less than 20 to 25 per cent.

While the capability of a steam engine and dynamo is easily determined within tolerably close limits, it may be objected that a similar factor for a gas works is by no means so definite. By the exercise of a little management—such as raising the heats and shortening the period of charging, etc.—it would be possible to go beyond the maximum. But such increase could only be obtained by means of an additional consumption of fuel, enhanced wear and tear, and a disproportionate increase of expenses all round. So it may be left out of calculation, and the capability of a gas works taken at that afforded by working under the usual conditions. The objection may also be made that it would not be possible to work the plant at its full capacity, or thereabouts, from one year's end to another; but as the figure is simply an arbitrary one, taken for comparative purposes, this objection does not apply.

As exemplifying the useful information afforded by the load factor, attention may be directed to fig. 1, which shows the monthly consumption at a small country gas works for the year ending Sept. 30 last. It is not supposititious, but a representation of actual fact, though I am not at liberty to give the name of the undertaking. The plant is equal to a

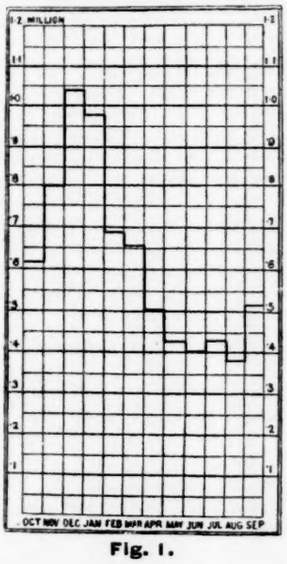


Fig. 1.

production of 1,200,000 cubic feet per month of 30 days, and therefore the perpendicular lines are divided to show this quantity in twelve divisions, each representing 100,000 cubic feet. It is sufficiently wide to include 12 divisions; one for each month. The average monthly consumption, beginning with 614,000 cubic feet for October, 800,000 cubic feet for November, etc., is then marked in as shown, thus supplying a graphic representation of the load factor for each month. The effect of the unusually severe weather last December and January is seen by the large consumption of gas; and the fact that the summer consumption does not fall below about one-third of the maximum, is satisfactory evidence of the use of gas for purposes other than lighting. The depression for the month of August is due to the absence from home of some of the principal families in the district. In a paper read by the present writer before The Gas Institute in 1889, a diagram is given showing the quantity of gas supplied daily throughout one year; and it constitutes an example similar to the above, as indicating the proportion between the actual output and the maximum capability of the works. Fig. 2 is a diagram similar to fig 1, but for works ten times as large, and the

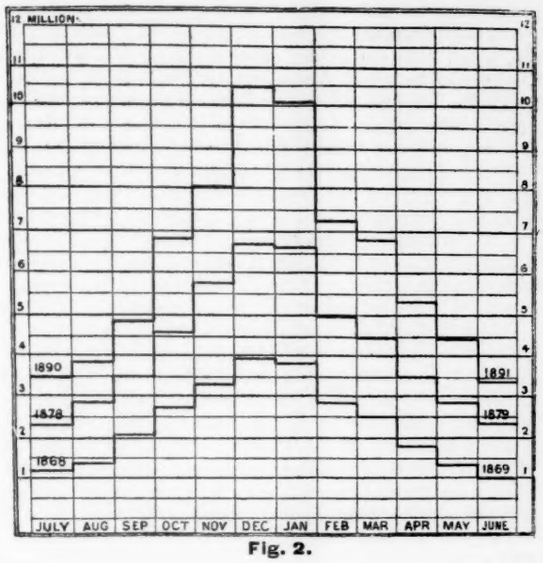


Fig. 2.

divisions therefore represent hundreds of thousands; making 12 millions for the whole in this case. Although quite a different works, there are some striking resemblances to fig. 1, in the matter of the variation in demand from month to month. An interesting example of one of the uses to which such a diagram may be put is given by adding lines showing the monthly consumption for 1868-9 and 1878 9. By diagrams similar to these, it is possible to show the advance or otherwise during a period of years; and when several successive years are indicated on one diagram, I have found that each can be distinctly delineated by using different colored lines, with a distinctive tint for each year.

A great deal might be said here on the application of the load factor to the history of a gas undertaking throughout a period of years, and its utility as a means of indicating the effect of certain definite acts on the part of the management—such as reductions in price, changes in quality, introducing schemes for letting apparatus on hire, or otherwise facilitating the use of gas. No doubt, a careful study of a series of such diagrams would give a clearer idea of the numerous causes that have tended to influence the quantity of gas consumed, than could be obtained in any other way. But it is not proposed to follow this direction further than pointing out that the fluctuations shown on the load factor diagram have an intimate relationship to the selling price of the product. A plant of a certain given capacity represents a certain amount of sunk capital; and as this capital would not be forthcoming, in the first place, unless there was a fair prospect of a reasonable profit or dividend being earned by its means, we may take a completely equipped gas works (say) equal to the production and supply of 1,000,000 cubic feet of gas per diem, as representing a paid up capital of £200,000 sterling. Five per cent. interest would be a reasonable rate; and the schedule of prices would be so arranged as to admit of a sum sufficient to meet this claim being earned every year. To put it another way, the price would be so adjusted as to leave a remainder of some £10,000, after liquidating all working expenses and charges incidental to the carrying on of the concern. With an annual load factor of the full capacity, an addition of only 6.6d. per 1,000 cubic feet of gas sold would be sufficient for this purpose. This, of course, would be unattainable; but suppose we have the good fortune to be able to record an average annual load factor of 0.66. An addition or loading of 10d. per 1,000 cubic feet would then be necessary; and if it was not more than 0.5, 1s. 1.2d. would be required. With a low average load factor, the necessary charge assumes considerable proportions. With one of 0.25, it would be 2s. 2.4d.; and with one of only 0.1, it would be no less than 5s. 6d. If the load factor is low, the rate must be high, and *vice versa*, as it varies in inverse proportion. All other things being equal, a load factor of 0.25 would mean a charge of 1s. 1.2d. per 1,000 cubic feet higher than one of 0.5. When dealing

with very low load factors, a high price must necessarily be charged. If it is considered that a high price is inexpedient, then the shareholders must be satisfied with a very low rate of profit; or it may even be considered advisable to work the concern temporarily at an actual loss, so as to develop the business and afford opportunities for earning profit in the future.

In all commercial undertakings—whether gas, electric light, or anything else—the first outlay of capital includes preliminary or establishment expense, comprising several items that are incurred once for all, irrespective of future extensions of business. Besides this, in providing the working plant, there are several directions in which a considerable excess of power can be provided at a trifling additional cost. In the case of gas works, it is wise to take up a good area of land in the first place, as much difficulty and extra expense would arise in buying it afterwards. The difficulty and expense of laying mains, renders it desirable to exercise a reasonable foresight as regards probable future requirements. No one would dispute the wisdom of so designing buildings that they may be extended in any one direction at a future time, or allowing for the telescoping of gasholders. The first outlay, therefore, represents a nucleus or nest egg which can be added to at a less than proportionate expense. The cost of doubling the productive capacity of plant, especially if it was judiciously laid out, with an eye to such a contingency in the first place, need not be so much as half the original cost. In this way an increased business, if it does not improve the load factor, will operate in the direction of reducing the proportion between capital and the annual receipts. It would be easy to quote examples of gas undertakings that have been greatly improved, while the load factor may remain the same, or but little affected. In some districts, the adoption of gas for warming has been so considerable as to entirely neutralize any advantage in respect to summer consumption—for what gas engineers call summer consumption is the same thing as increasing the load factor—that is gained by the increased use of cooking stoves, as secured by cookery demonstrations, or exhibitions of apparatus. Or improved lighting appliances may come in with similar effect. There are few undertakings in such a position that the cash value of the load factor must remain a fixed quantity; and therefore it usually turns out that the additional heating and lighting business is a direct benefit to all concerned.

The load factor is, after all, a theoretical quantity, acquiring importance only on account of the money value represented by it. We must consider not only the proportion between capital, as determining the amount required for interest and working expenses, but the value and amount of each as compared with the selling prices which commercial considerations render practicable. For example, there may be a particular commodity not in regular demand, but for which such a price is readily secured as to render any question of working expenses, interest, etc., of no practical importance. If a large profit is obtainable from it, the charges proper to the credit of the revenue account may either consist principally of interest on capital, or be largely made up of working expenses, without affecting the main issues. Either one or the other, or perhaps both, may be so small as to possess no appreciable weight in the matter. It is when we are considering the question of cutting down prices, so as to put the thing on the market at the lowest possible figure, that these factors come in, and every pains is taken in the way, not only of reducing the working expenses, but also of cheapening the first cost of the plant. This may be done by the invention of improved methods of working, or by increasing the productive capacity of the existing apparatus.

If the amount necessary to pay interest is small as compared with the working expenses, then the effect of the load factor on the selling price is also small. Where the converse is the case, and the working expenses are comparatively small, the load factor may assume such proportions as to control the possibility or otherwise of supplying the commodity at remunerative rates. In the manufacture of pure sulphuric acid, for instance, it is said that a platinum still, the joints of which are soldered with gold, is used. The value of the apparatus may be some thousands of pounds; and unless the product admitted of a large profit it would not be used. As regards the manufacture of gas, it is well known that, with good management, the amount of capital expended need not greatly exceed three times the annual receipts. The electric light industry is not sufficiently advanced to enable one to fix definitely upon a proportion between capital and revenue; but it is safe to say that the load factor is of more importance in its case.

At present the supply of electricity in England is in the same position as gas occupied about 50 years ago, when it was only used for lighting purposes, and that to a very limited extent; in the United States, I believe, something has been done in the way of electric motor engines. The load factor is therefore low, particularly in country towns. In London, where fogs are frequent, day consumption is occasionally obtainable; but the real requirement is a good demand for electricity, say, for cooking, motive power, or other daylight use. Failing this, contracts for the regular use of the light—like public lighting contracts, covering the whole of the hours of darkness—are the best substitute obtainable. Some of the American electric supply companies have so far recognized the importance of this as to fix their contract prices at so many hours per lamp per day, and to allow large discounts as the number of hours is increased. If the lighting of cellars or underground stations can be obtained, where it would be required during the whole of the working hours, so much the better. But under present circumstances the commercial possibility of supplying electricity as a paying concern appears to turn upon one of two things—either the load factor must be largely increased by the securing of regular long hour customers, or else the amount of capital required must be largely reduced by introducing new and cheap methods of generating and distributing electricity.

Of course there are always a certain number who are willing to take electricity at a high price as an article of luxury. While in fashionable localities, where a large number of the wealthier clases are congregated together, it might be possible to do business on these lines alone, it may be taken that the only way of making a prosperous business in an ordinary district is to cater for the middle classes in addition. With these, at any rate, the question of cost is the chief thing. They are willing to put up with some inconvenience if money can be saved by it; and a promise of indirect economy, by the preservation of gilding, paint, ceilings, or stored goods, does not appeal to them so strongly as a guaranteed cash saving. When the inhabitants of country towns are canvassed by suppliers of electricity, they usually wish to stipulate that it should not cost more than gas. It would be easy to make out a good case for high-power oil gas on the score of purity, less vitiation of atmosphere, etc.; yet when sold at a corresponding value, light for light, it will not compete with the cheaper though inferior coal gas.

Another practical disadvantage is the absence of a cheap and reliable electric meter, measuring not the current or quantity only, but the actual cash value supplied to within a small percentage, without loss or waste. I may be wrong here, but I believe that the principle at present adopted in measuring electricity as used by consumers is that of bye-passing a known fraction and using it for the deposition of metals. This method is objectionable as being only inferential and wasteful. It is inferential as leaving the bulk of the current untouched, and wasteful in that the portion of electricity used for depositing the metal is unavailable for any other purpose. Possibly the quantity of electricity so used may be very small—practically of no more importance than the flash-light that is left burning in a large gas lamp. But in cases of dispute between buyer and seller there will always be the question as to whether the "fractionation" has been accurately performed. Being intangible and unrecognizable except by the shock or by production of heat, it seems probable that electricity could be more easily wasted than gas by the use of unsuitable or cheap appliances, or by careless or indifferent management. Disputes as to the accuracy of gas meters are not unfrequent, even now that the construction of them is generally understood; so a measuring instrument on the principle of the present electricity meter would likely come in for even a greater share of odium.

The Uses of Burnt Clay Mortar in Italy.

The United States Consul (Mr. Heath) at Catania, in his last report, says that visitors to Catania invariably notice and remark on the peculiar soft pink color of all the unpainted buildings. This coloring is the result of using cement or mortar of proved value, found in the vicinity, and which is nothing more or less than burnt clay. In the frequent eruptions of Mount Etna in times past, great beds of clay were covered and buried from 20 to 200 feet by the lava streams, with the result, when the eruption happened in the dry season, of burning and converting these clay beds into a fine red gravel or powder. These deposits are mined, and are considered very valuable. The material, mixed with a little lime and the usual amount of water, forms a mortar or cement considered superior to any other cement for building purposes, and has been used in Catania to the exclusion of all other materials for many centuries. Every building in Catania is constructed of lava liberally cemented with this mortar. In building, small irregular stones are used, just as they happen to come, and a smooth surface is afterwards given by a thin coating of mortar inside and out, which can then be divided by a trowl to imitate blocks of stone, if desired. This burnt clay, with lime, makes a very strong and adhesive mortar; no

other material would hold together the large four and six-story apartment houses, which are built entirely of small irregular stones. It also has unequalled wearing and resisting power, as the extensive harbor breakwater proves. This breakwater was built some 10 years ago, and extends for three-quarters of a mile out into the sea, and is said to be as good to-day as when first built. It is composed entirely of lava, and for a foot below watermark to a sufficient height to protect the shipping, of huge blocks of small lava rubble liberally cemented with the mortar. The constant wear and tear of the sea for 10 years has only damaged the cement in insignificant places, and probably only where there happened to be an air space between the mortar and stones caused by faulty construction of the blocks. Consul Heath adds that the more he looks into the matter the more he is convinced of the value of this mortar as an economical substitute for all the high-priced hydraulic cements now used, and might well be adopted in other countries besides Italy.

[Concluded from page 43.]

Modern Ventilation.

The light which I have found to answer best is the vertical flame system of William Sugg. This adopts burners of steatite, that extraordinary material which, soft as meerschaum naturally, attains a maximum hardness when heated to the melting point of cast iron. It is non-conducting and practically everlasting, non-corrodible and unalterable in dimensions by heat or cold. A cluster of such burners up to the required greatest power are placed immediately below the mouth of an extracting shaft, communicating direct with the open air, either perpendicularly or horizontally. You will probably, and naturally, think that a flame burning vertically close to the ceiling wastes the greater part of its light upon the cornice of the room, but it is not so. The experiments made by Mr. Dibdin, chemist to the London County Council, and who is fast attaining the rank of one of the first scientists of the day, prove this conclusively. He found, and stated before the Society of Arts, that the angle of 45° to the vertical of the flame under test gave the greatest result in light. In the ingenious ventilating light of which I speak, the downward rays at that angle cover the outer area, whilst the upward angle rays are returned to the spot immediately below the light by an enamelled iron reflector. Thus a result in light of great brilliancy and economy is obtained. The heat of combustion, being enormous immediately over the flame, ascends through the aperture provided, and travels along the shaft. Now this shaft is the subject of a further patented invention, and is lined throughout with a material known as asbestos felt. This absolutely prevents any condensation (which occurs when the products touch the bare tube, and which is not at all prevented by covering the outside of the tube) and not only so, but utilizes the great principle in ventilating, viz.: the conservation of heat. Not only is the outer case kept cool, but the inside is kept hot, and whether the shaft is horizontal or vertical, the heat is sustained with little loss through its length. At a suitable point communication is restored between the inner hot shaft and a tertiary flue or casing, which opens into the room round the ventilating light, and with the impetus gathered from its travels (for you will remember it is not losing heat) the inner cone of hot air rushes out, causing an aspiration in the outer air tube equal to the action of a gale of wind at a happy angle upon an open tube. Thus, by aspiration and expansion, the air is drawn from the room in quantities controllable by simply turning a tap, and the output varied from 15,000 cubic feet per hour to 300,000, for a foot of gas in such an apparatus as I have described will extract nearly 3,000 times its own volume of air.

The question of "back draught" or "down draught" is one which will occur to many of you, and it is an important one. We can stop a blow-down with a cowl, but what cowl will stop air from passing down it if sucked into the room by some force greater than the wind's action on the cowl? If a fire is burning at the foot of a tall chimney, the outlet of which is higher than the cowl, how can we prevent the fire from drawing its air supply from this convenient, cowl-protected inlet in the roof? As I have said before, no cowl of itself may stop it. But in the ventilating light scheme the difficulty is surmounted by the insertion in the cowl of a disc of talc or similar material, which is perfectly flat, and rests upon the end of the shaft, which, being carefully and squarely cut to meet it, makes a sound joint, air-tight against any external air. The disc is threaded on a central pin, and is attached in no other manner, nor can it become rigid in any way. Now the theory of this valve is bound up with that of the non conducting lining; each is to some extent imperfect without the other, but together they utilize that power which has, I think, never before been brought to bear on ventilating lights. This is the "conservation of heat" already mentioned. You are aware of the rule which makes hot air ascend—it is simply pushed up by the weight of cooler air descending, and the impulsive force of heated air is according to the degree to which it varies from air at normal temperature. We will instance a column of air one foot square by twenty feet high. This weighs about 1.6144 lbs. What keeps this volume of air from rising will be the fact that neighboring columns of air the same dimensions are at the same temperature. We will consider such a column as being contained by a non-conducting shaft, twenty feet long by one foot square. This we will suppose to be subjected to heat, but before applying the heat, we close the top of the column with a flat plate of no weight, and on this place shot of known weights. When the heat is started the air in the column expands, and at first the surplus contents flow out at the unclosed end. The hottest air rises up the shaft to the top under the plate, and a pressure is exerted upon the plate equal to the differences in weight between the heated air in the column and a similarly sized column of unheated air. If our column of heated air is at 480°, then we have doubled its volume, halved its density, and obtained an upward pressure of half its weight, that being the difference between the heated column and an imaginary cool column. So, if the plate we speak of is weighted to .7 of a pound, still the upward force will lift it, and *nota bene*, if a down draught passes upon the plate to any extent less than the upward impulse, the plate will still be lifted up and the exit take place in spite of down draught. This place is represented in our ventilating schemes by the exit valve, the disc. We will suppose an external compression of the atmosphere to exist which holds this disc-valve tightly on its seat, then the heated products from the ventilating light fill the tube right up to the valve, and, losing very little heat by the absorption of the shaft, continue to get hotter until the upward pressure exceeds that of the down pressure, forces it back and makes exit. Should the down pressure be severe, as long as it does not exceed the .8 or .9 per square foot, the conservation of heat (soon reaching 400° or 500°) will cause an exit to be forced. Thus a down pull on a ventilating outlet may be overcome, and with these inventions ventilating exits may be made in places which have been impracticable hitherto. But we have another assistant in this matter. The exit valve spoken of is placed in one of the powerful Sugg cowls before mentioned, so that not only does the light cause extraction, but the cowl does its work when no light is going. Its work is such that the mere passing of a wind across it will cause extraction and keep the valve balanced in the current until a cessation in the upward current, and the consequent threatening of a down draught, will restore it to its seat. But you will say with reason that such a cowl extractor with a heavy wind will cause undue ventilation. By a simple mechanical arrangement the exit valve is in exposed situations made to act as a regulator, which allows free outlet so long as the fixed output is not exceeded, but, under a violent extraction, closes the orifice in proportion to the increased suction, keeping the output regular and unaltered. For about two years some of these have been in work, and have never failed, nor can any trace of wear or disorder be perceived; apparently they are good as ever, although exposed to the full heat of ventilating lights (in one case within three feet of the flames).

As regards the efficiency of this system of gas ventilation, I examined recently an installation at the Grosvenor Museum, Chester, whence unventilated lights had been removed. In this case the committee, sitting under the presidency of the Duke of Westminster and the chairmanship of Sir Horatio Lloyd, had carried out extended experiments in the rooms of the Technical Education Department, and authorized the honorary Secretary, Mr. J. R. Griffiths, of Chester, to give a certificate to the effect that the temperature of the rooms did not rise 1°, with the rooms full of students and after hours of work. The lighting was characterized as perfect.

The question of air inlets must be answered; but I should hesitate to advocate the arrangement of a greater area of inlet than outlet, unless circumstances precluded the ample distribution of the inlet orifices.

There appears to be no one of our conditions with which ventilation by gas lighting does not comply if carried out as I have described. It is cheap if put in when the building is going up, the light itself being the only item of cost worth considering. It can be fixed almost anywhere and can be made to work well. At one stroke the lighting and ventilation are accomplished and you have the best of both. There is no advantage claimed for electricity which is not possessed by gas so used—cleanliness, coolness and efficiency—and comparison does not exist upon point of cost. Every small house could be fitted whilst building with the shafting, leaving the tenant to select his light, and this he could buy at as little cost as a gasalier. Finished houses can be ventilated without pulling them to pieces, and the parts of the system which

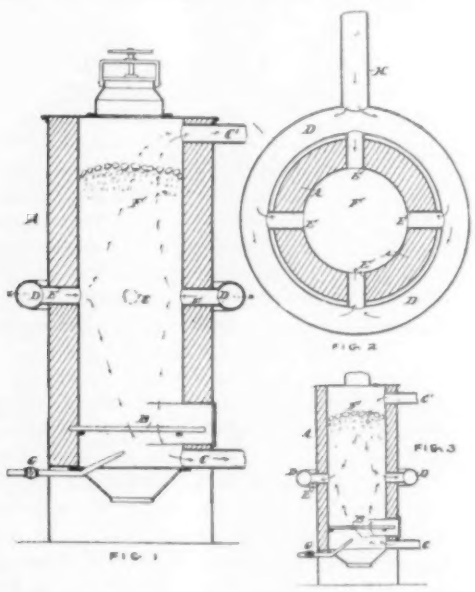
would be considered fixtures and unremovable are the cheapest parts of the installation. The light may be in powers from 16, to 2,000 candles, and will last for years. There is no danger in their use, and gas explosions from sliding and other imperfect chandeliers are abolished. You only pay for gas (less than you would for a less scientific system), and you get ventilation into the bargain. You have an ever-ready mechanical force, which will at any time educt vitiated air from the room by the simple means of a lighted match and a turned tap.

The Clark Process of Manufacturing Water Gas.

On the 5th inst., U. S. Letters Patent were granted to Mr. Walton Clark, of Philadelphia, Pa., for an improvement in the method of manufacturing water gas, and the inventor assigned the same to the United Gas Improvement Company. Using the words of the specification :

My invention relates to the process of manufacturing water gas or mixtures of water gas with coal or other gases, and has for its object to render the preliminary blowing up of the charge of fuel in the generator to a state of incandescence prior to the admission of the steam more rapid and economical.

Heretofore the general practice has been to cause the air blast to traverse the charge of fuel in one direction, and where the charge was of considerable depth, as it must be for efficient use in producing water gas, the carbonic acid gas produced in the part of the charge where the air first enters it was largely reduced to carbonic oxide in passing through the deep fuel bed with the result of an incomplete combustion. This has attracted attention of gas engineers and it has been sought to avoid it by building comparatively shallow beds of fuel in two connected generators, blowing them up independently, and then causing the steam to pass down through one bed of fuel and up through the other. There, are, however, drawbacks to this method which have prevented its general adoption. I have discovered that a very complete combustion and



rapid ignition can be attained with deep charges of fuel by causing the air used in heating up the generator to enter at or about the center of the charge and pass in opposite directions through the upper and lower portion of the charge, respectively, the products of combustion issuing from the generator through exit passages provided at its top and bottom, or the obviously equivalent method may be pursued, which consists in causing the air to enter the generator at the top and bottom thereof and pass down through the upper part of the charge and upward through the lower part thereof to a substantially central zone, where the products of combustion are drawn off. The charge being thus ignited by causing the air to pass in opposite directions through the upper and lower parts thereof, the water gas is generated in the usual way, the air being shut off and the steam passed through the whole mass of the highly ignited charge in one direction. It is obvious that the air used in heating up the generator may be made to pass through it either by some form of blower connected with the inlets or some form of exhauster connected with the outlets for the products of combustion.

In the accompanying drawings I have illustrated a generator especially adapted for carrying out my improved process, Fig. 1 being a central sectional elevation, Fig. 2 a cross section at $x x$ of Fig. 1, and Fig. 3 showing the alternative mode of using my process.

A is the generator, B the grate supporting the charge, and C and C' pipes serving either the purpose of air pipes or of exit passages for gases.

D is a ring of pipe shown as connected with a conduit H and having branches E leading to the inside of the generator at or about the plane which would pass through the center of a full charge of fuel. These pipes, like $C C'$, can be used either as air pipes or as gas exit passages.

F indicates the charge of fuel, and G is a steam pipe.

In Fig. 1 I have indicated by the arrows the entrance of the air through pipes E, its passage upward and downward through the charge, and the escape of the products of combustion through pipes $C C'$, and in Fig. 3 the opposite course is indicated, the air entering through pipes C C' and passing upward and downward through the charge, the gases escaping through pipes E at the central zone. In both cases when the charge is sufficiently well ignited the conduit leading from the pipes E should be closed and the steam introduced at the top or bottom of the charge and forced through its whole depth, the resulting water gas being drawn off as through pipes C or C'.

The Fiesse Gas Producer.

U. S. Letters Patent, No. 466,603, were granted on the 5th inst., to Mr. Charles Fiesse, of this city, for improvements in gas producers. In describing his invention, Mr. Fiesse says :

In the drawings, Figure 1 shows a longitudinal section of an improved form of blower and compressor for use in connection with my invention. Fig. 2 shows a longitudinal section of the gas producing apparatus proper. Fig. 3 is a detail view of a special attachment to the blower. Fig. 4 is an end view and partial section of the gas producer. Fig. 5 is a detail view.

The object of my invention is to produce a fuel gas composed, mainly, of hydrogen and carbonic oxide and also to separate the former from the latter as far as possible. The main fuel supply may be either atomized oil or pulverized coal dust alone or mixed with a suitable percentage of pulverized charcoal or coke which has absorbed or is loaded with any suitable hydrocarbon, such as Lima oil, fuel oil, naphtha, etc., sprinkled or poured over the charcoal or coke before or after pulverization. To the extent of the contemplated use of the former fuel, this invention may be regarded as an improvement on that described in Patent No. 433,336, granted to me July 29, 1890.

The apparatus herein described consists of a furnace F, of any suitable materials and desired shape, preferably in the form of the cylinder E', incased by a metallic shell, surrounded itself by a second metallic shell E, leaving a suitable space e between, forming an air chamber or jacket to warm, by the radiation of the fuel chamber, the air entering through suitable openings e'. In the bottom of the furnace is the grate D, bearing a mass of balls of compressed coal dust, charcoal, or coke C. Beneath this grate a supply of finely pulverized fuel is brought in through the pipe A by a stream of air from any suitable blower, though the form shown in Fig. 1 is preferred. Across this space below the grate extend two pipes B, formed of some proper porous material. Steam is supplied to these pipes B by suitable feed pipes b. Pieces H and H' cover the ends of the cylinders E and E' and serve to support the same.

h' is an opening containing isinglass, through which the condition of the bed of fuel C may be inspected, and h'' is an opening through which said fuel may be replenished. A suitable door (not shown) is also provided in the piece H' for taking away the ashes. Over the furnaces is a species of vessel S, having a perforated bottom containing a collection of broken stone or clay and oxide of iron or other suitable substances S', which may serve as a strainer and a purifier for the gases passing through. Through the opening s this supply may be renewed for cleaning. The grated bottom of this vessel is shown in Fig. 4 in section.

The sheet iron shell of the cylinder E' is continued up around the pot S and onward in the shape of a pipe E', as shown. Outer cylinder E is similarly continued in the shape of an outer pipe E. The space e between these shells and pipes is an air space, into which air enters at the bottom, as indicated by the arrows, Fig. 2. Inside the pipe E' is placed a third pipe of porous material M, leaving space G between the pipe E' and that M. Gases collecting in this space, as well as the heated air in the space e, can be drawn off by means of suitable exhausters and blowers (not shown) fixed to the pipe e'' and to pipe g.

The blower and compressor illustrated in Fig. 1 consists of the castings Y and Z and the cone X, bolted together and supported on standards X' and Z' and containing the revolving fans W and helical thread

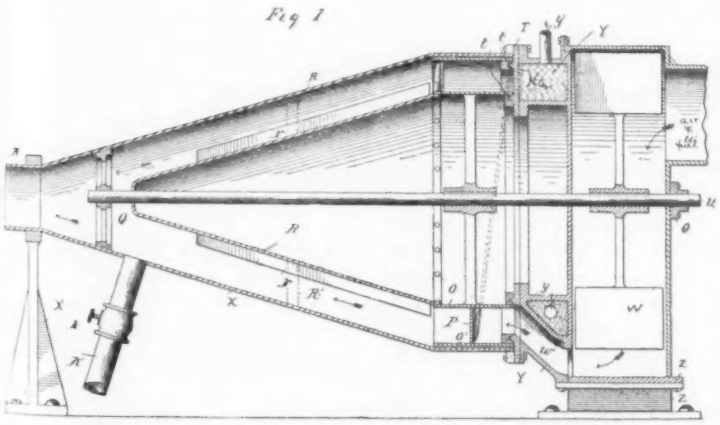
P. The shaft *u* revolves in bearings *Q* and *Q'*, and the fans *W* are keyed thereon. It also carries the two cylinders *O* and *O'*, provided with small friction rollers (not shown) on their edge, and the helical thread *P*, fixed between said cylinders. The inner cone *R*, carrying the small blades *r*, may be fastened to the cylinder *O* and revolve therewith, or it may be separated from it and rigidly connected to the casing *X* by studs *R'*, as indicated in dotted lines, Fig. 1.

The casing *Y* has its front closed for the greater portion of its circumference by the face plate *T*, thus forming a water space *Y''*, into which water is introduced by a pipe *y'* for cooling the face plate *T*, and from which it passes out by the pipe *y*. The face plate *T* is preferably made of some polished material that forms a good bearing, such as brass or Babbitt metal. Two rings *t t*, fixed on the rear edge of the cylinders *O* and *O'*, and provided with grooves V-shaped, as shown, filled with a suitable mixture—such as tallow and plumbago—for lubricating purposes, run smoothly on the corresponding V-shaped bearings on the face plate *T*, and so a minimum of friction is secured. The air or a minimum of air and pulverized fuel is admitted through the opening *w*. The passageway *w'* extends from the fan casing through the casing *Y* and through a suitable opening on the face plate *T* between the cylinders *O* and *O'*, bearing the helical thread *P*, and at last between the cones *X* and *R*, where the air is compressed. From thence the pipe *N* leads the compressed air into pipe *A*, which feeds into the furnace, as before described. The pulverized fuel is mixed with the air supplied to the blower by any suitable feeder.

A modification of the apparatus by which oil may be atomized and fed into the furnace is shown in Fig. 3. The tank *L* has an opening *L'*, through which it can partly be filled with oil, as shown. The float *I* acts as a piston to force the oil out through pipe *I'* when the pressure of compressed air transmitted through pipe *K* and controlled by valve *k* is brought upon the upper side of said float after the valve *n* has been closed. The valve *n* in the pipe extension *N'* being closed, the air passes through the pipes *E''*, atomizing the oil forced through the pipe *I'*, which is provided with an atomizer of any convenient form within the pipe *I'*, forcing it into the furnace under the grate *D* with a minimum of compressed air in the form of oil vapor through the flaring extension *I''* of the pipe *I'*.

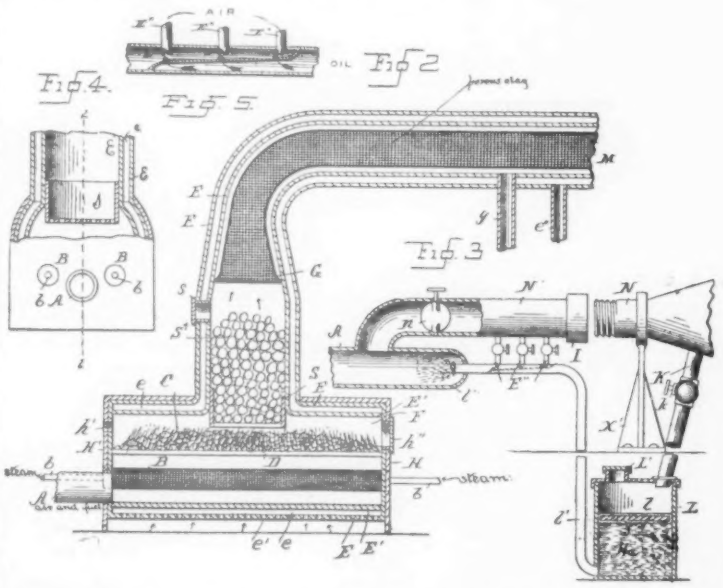
The operation of my invention is as follows: The bed of coal dust balls, charcoal, or coke on the grate *D* is blown up to a state of incandescence by a forced draft. This may be derived from the blower (shown in Fig. 1) by closing the valve *k* and all the valves in the pipes *E''* and leaving the valve *n* open. The air is then driven out through the cone *X* into the pipe *N*. *I* is the screw joint by which extension

Fig 1



N', is attached to pipe *N*. After the fuel is sufficiently incandescent the pulverized fuel is fed into the supply pipe *w* of the blower and into the furnace with the compressed air blast through *A*. Entering into the furnace the compressed air blast, loaded with pulverized fuel, diffuses itself all around the outlet, thus avoiding any destructive effects of the blast, and is ignited. The pulverized fuel burns out very fast in producing carbonic acid. By rising up through the bed of glowing fuel in the upper part of the furnace the carbonic acid takes up another atom of carbon, which converts it into carbonic oxide.

After a run of about five minutes the blower is stopped. Then the steam is introduced into the porous cylinders *B* by means of the pipe *b*. The radiation of the heat in the lower part of the furnace having highly heated the porous cylinders *B*, it follows that said steam is readily superheated and passes through the pores of the pipes *B* nearly dissociated, according to the laws of "dissociation." In rising through the bed of glowing fuel the oxygen of the steam will combine with the carbon of the fuel, because of the high temperature and volatilization of the carbon in the furnace. Carbonic oxide will thus be produced and the hydrogen of the steam liberated. The transformation of the carbonic acid into carbonic oxide and the decomposition of steam to form carbonic oxide and hydrogen, said transformation and decomposition taking place in alternate runs of about five minutes each, the furnace being fed with pulverized fuel or atomized oil in the first run and with steam in the following run, will give off a great and even flow of gases, in which the nitrogen of the air, the only non-combustible element, will amount to less than 35 per cent. of the whole product.



The heated air passing up through the space *e* can be drawn off through pipe *e''* by a suitable exhauster and used for heating purposes, or as a hot blast to aid in the combustion of the gases generated by my apparatus. The gases generated by the various reactions in the furnace pass up through the pipe *M*. This pipe being porous, the hydrogen passes more freely through its pores than the heavier gases by reason of its feeble density and of the great molecular activity resulting from the high temperature of the gases, since I know that endosmosis is a consequence of the molecular movement, and that each gas is impelled by its own peculiar molecular force, which, in hydrogen, is greater than any other gas, and by the exhausting action of a suitable exhauster and blower fixed to pipe *g*. The gases collected in the annular space *G*, Fig. 2, have, therefore, a higher percentage of hydrogen than those remaining in the pipe *M* and can be drawn off through pipe *g* and burned or stored separately from the gases delivered by pipe *M*. The heavier gases pass on through a metallic extension of the pipe *M* (not shown), and may be burned in any suitable apparatus or stored up for future use.

It should be understood that when the separation of the hydrogen from the carbonic oxide is not required the porous pipe *M* shall be removed and the various changes in the shape of the various parts of my invention may be made without departing from the spirit thereof so long as the relative arrangement of parts is preserved and pulverized fuel or atomized oil used.

Forms of blower and compressor other than that illustrated may be used, and various kinds of porous material employed to form the elements which should have a porous construction, as described.

The proportion and composition of the liquid to load charcoal or coke may be changed, and either pulverized coal or other pulverized fuel may be mixed with pulverized charcoal or coke, or vaporized or sprayed oil may be used, as provided for.

Current Fallacies Concerning Portland Cement.

We repeatedly endeavored, says the *Engineer*, as will be seen on consulting our back numbers of to keep our readers well informed concerning the results that have been deduced from time to time from researches conducted by technologists of proved ability upon Portland cement, and to perform the no less necessary task of scotching, and, if possible, exterminating those mischievous fallacies which have arisen concerning the same material, from misapprehension on the part of a conscientious experimenter, or from semi-unconscious bias of one with less power of mental and moral discrimination, with, we will venture to affirm, a measure of success sufficient to warrant a renewal of our efforts upon adequate occasion. Although thoroughly convinced that the intelli-

gence of the main body of engineers will ultimately enable them to choose between accurate conclusions based upon experiment properly devised and executed, and inaccurate though often authoritative assertions resting upon clumsy or *dilettante* experiment, or upon mere opinion, be it never so imposing, yet we should be failing in our duty, says our authority, were we to hesitate to guide that intelligence and to hasten the dissemination of sound views upon a subject the importance of which is conceded by all. The three papers dealing with Portland cement recently read before the Institution of Civil Engineers afford sufficient indication that many important points in the manufacture, testing and use of this material are so far from being perfectly clear, even to those generally supposed to be well acquainted with the matter, that their debate and elucidation are not only in themselves desirable from a polemical point of view, but are of urgent necessity for the information of the practicing engineer who is less directly concerned with the determination of questions of principle than with the settlement of the working limitations of a substance which he may be called upon to use, or may already be in the habit of using for structures upon the permanence of which his future reputation and career may largely depend. Such being the case, we will review and refute the most persistent and dangerous of those fallacies which appear still to possess a certain vogue.

It is somewhat distressing, but by no means surprising, to find that the dispute, more ancient than venerable, between engineers who demand a cement of high strength, and those who as sedulously reject cement of this character, or as they have been epigrammatically, if inaccurately, termed "over-liming engineers and engineers," is still raging, and seems to be in no immediate danger of extinction. The reason for this astonishing vitality may be safely assigned to the circumstance that both parties having based their arguments upon premises which are not only erroneous but even incompatible in error, their agreement cannot conceivably occur. Those who look to the strength of cement as its most important property are misled by analogy—fruitful source of blunder—with other structural materials of less complex kind; and yet we scarcely think that they would use an agglomerate of Rupert's drops as a substitute for the much softer glass commonly inserted as basement lights in street paving. Those who, knowing that some strong cement is unsound, and finding that the cement offered them is strong, conclude that it is unsound, are guilty of as gross a fallacy as was ever pilloried as a mnemotic syllogism in a text-book on logic. It is the former school that has imposed upon the manufacturer conditions which can only be complied with at the risk of producing an overlimed cement, provided the present somewhat lax methods of manufacture be retained—a laxity for which the low prices now current are partially responsible. It is the latter which has stood in the way of improvement, by failing to demand from cement makers as good a material as may be legitimately required, and is easily produced by the exercise of due care and skill. Both have called in the aid of the chemist, and after having obtained from him the figures of his analysis, have proceeded to pronounce upon the quality of the sample analyzed with their pet pre possession as sole guide. Had they been wise enough to ask for his opinion based upon these figures—always assuming that he possessed a special and intimate knowledge of the technology of cement—their invocation of his aid would have been more to the point.

How completely impossible it is for any but those who have received a thorough chemical training, have subsequently acquired complete familiarity with all that has been done towards putting the chemistry of cament upon a sound basis, and have superadded thereto that experience which is only to be bought by close and daily contact with the chemical problems arising from the manufacturing difficulties of the cement maker, to speak with authority upon any question of the kind indicated above, may be realized when it is stated that the percentage of lime alone gives absolutely no certain criterion of the quality of cement; that even the possibility of the cement being sound or otherwise can only be judged by a consideration of the whole of the constituents other than lime, as well as of the lime itself; and that the opinion thus reached can only be of solid value when due regard has been paid to the results of a complete series of mechanical tests. Engineers who are uneasy when the percentage of lime in a sample of cement is greater than 55 per cent., and those who consider themselves enterprising when they obtain one with 62 per cent., may alike profit by the remark that it is perfectly possible to prepare a cement otherwise normal in composition with less than 55 per cent. which shall be thoroughly unsound, and one with 65 per cent. which shall be sound and unexceptionable in every respect.

As for the theory which has lately been mooted, that a Portland cement of ideal composition should contain about 50 per cent. of lime, it would be ludicrous were it not mischievous; ludicrous because it has been advanced in ignorance or contempt of the inexpungable researches of Le Chatelier, and mischievous because it is possible that it may deceive the unwary, even to the extent of leading them to chase an *ignis fatuus* more than commonly illusive. Any attempt to confuse the point at issue by reference to slag cements, or, indeed, to any cementitious material, other than Portland cement, which may contain such a percentage, must either proceed from lack of chemical knowledge, or be deliberately disingenuous. Cements of which slag cement may be taken as a type differ wholly in constitution from true Portland cement, consisting as they do of mixtures of acid silicates of highly active character with slacked lime, while Portland cement consists essentially of tri-calcium silicate, together with tri-calcium aluminate, both absolutely anhydrous until the moment of setting.

Closely associated with the erroneous ideas which we have endeavored to dispel in the foregoing portion of this article is the notion that the whole, or at least a considerable portion, of the lime in Portland cement is in the free state. This heresy is commonly defended on the ground that a considerable percentage of free lime is reported as existing in cement in some analyses, and upon the observation that the water in tanks in which briquettes of cement to be tested are kept is strongly alkaline, and a white scum of lime will appear upon the surface of the water, and sometimes upon the briquettes themselves. The occurrence of similar white incrustations upon concrete blocks gives countenance to the same superstition. Each of these errors is due to ignorance of the chemistry of cement, and to that alone.

The return of such and such a percentage of free lime in the analysis of normal Portland cement arises from the analyst making that return, though possibly skilled in other branches of analysis, being engagingly unsophisticated as far as that of cement is concerned. His probable line of reasoning may be stated thus:—"I am required to determine the percentage of free lime in this sample of Portland cement; if I extract a weighed quantity repeatedly with boiled-out water in an atmosphere free from carbonic acid, or preferably with sugar solution, seeing that lime is more soluble in that menstrum, and determine the lime thus removed, I shall have done all that is requisite," the worthy man being unacquainted with the elementary fact that the true cementitious compounds present in Portland cement are decomposed by water or a solutiox of sugar, lime going into solution as calcium hydrate. The belief of the unskilled observer that because lime is present in the water with which cement briquettes have been in contact, and appears—as carbonate, it is true, but such fine distinctions are not for him—on the surface of the water and upon briquettes and concrete, it must, therefore, be present in cement in the dry state, arises from his ignorance of the fact that the reactions which constitute the setting of Portland cement are attended by the production of a certain quantity of calcium hydrate—slaked lime—which gives rise to the phenomena whence his deductions are drawn; his observations are correct, but his conclusions faulty. It should be once for all grasped that Portland cement of perfect quality contains no free lime; Portland cement of good ordinary quality contains but a trifling quantity of free lime, probably not more than 1 per cent.; no method exists by which the amount of free lime in Portland cement may be estimated.

We have stated some or all of these truisms before, but, from the astonishing nonsense that has been lately spoken and written upon this subject, reiteration, even *ad nauseam*, is evidently necessary. It is true that a method has recently been devised and described in these columns—namely, the Deval hot test—for detecting free lime and unsoundness generally in Portland cement; but it is a purely mechanical process, and although of inestimable value to the cement tester and user, as indicated by its daily increasing adoption, and the excellent work that has already been done by its means, it does not pretend to accomplish that which analysis has hitherto failed to achieve.

No list of fallacies concerning Portland cement would be complete without that hoary imposter, the magnesia bogie. We almost hoped that we had succeeded in disposing of this astral body, but it appears to have revived in Germany, and been recently "precipitated" with some violence in an august assembly near home, damaging a good many reputations of established decorum in its fall. It is a humiliating necessity to be compelled to point out that the magnesia in Portland cement is one thing, and the "magnesia" precipitated from sea water by contact with Portland cement quite another. Here, again, the whole of the confusion has arisen from chemical ignorance. Ignorance of chemistry in an engineer is no crime, but it is a misfortune that should lead him to adopt, when approaching what is, after all, a purely chemical question, an attitude of less complete "cocksurety" than is sometimes, we regret to say, assumed.

The magnesia in good, normal Portland cement of English make forms but a trifling percentage of the whole, and is thoroughly inocuous. This point we have dealt with at length some time since, and we cannot spare space to recapitulate our facts and arguments. The question is settled, and may be dismissed forthwith. Magnesia precipitated by Portland cement from sea water is a different body altogether. In the first place it is not magnesia, MgO, but magnesium hydrate, $Mg(OH)_2$, and nothing but an irrational dislike of exact terms, merely on account of their possessing an unfamiliar sound, can account for the loose habit of conferring upon it a name already appropriated. If this difference of nomenclature could once be fully comprehended by the sufferers from one form or another of what we once ventured to name "the magnesia scare," the distressing symptoms still so prevalent would abate, and return to comparative sanity speedily ensue. Having thus decided upon our terms, the discussion of the question is much simplified. When Portland cement present in concrete is brought into contact with sea water which contains considerable quantities of magnesium salts, a reaction between them takes place; the first effect of which, probably, is that the calcium hydrate, formed, as mentioned above, on the setting of the cement, precipitates magnesium hydrate from the sea water, the lime it contains simultaneously being converted into the corresponding calcium salts, and removed from the cement in solution. Should the access of the sea water to the cement continue, either on account of undue permeability of the concrete, or the presence of fissures or flaws, the hydrated silicates and aluminates of calcium constituting the essential part of Portland cement will be similarly attacked, and the reaction will proceed until the cement *qua* cement no longer exists. The magnesium hydrate mixed with other decomposition products which appears where this reaction is occurring—in a word, the white deposits and incrustations of so-called "magnesia"—is only an effect of the mischief that has been done, and in no sense its cause.

Fallacies less widespread and harmful than those we have cited exist in plenty, but, although fully alive to their pernicious prevalence, we do not propose to deal with them at the present time, lest the importance of those we have specifically attacked should be lost sight of in the crowd of petty offenders. We shall be content if we have succeeded in bringing any one of the bigger rogues to book.

Historical Sketch of Coal Mines and Mining Operations in Allegheny, Pa.

Mr. Selwyn M. Taylor, M. E., in the "Reports of Inspectors of Mines of Pennsylvania, 1890," says that portion of Allegheny county lying south of the Ohio and Allegheny Rivers is practically one coal field of the Pittsburgh bed. That part of the county lying north of the rivers is too low, or rather the rise of the measures to the north has carried the coal out of the hills. That part of the county, however, as well as the southern part, is solidly underlaid by the "Freeport bed," which, on the failure of the gas supply, may become an important feature of the coal production of the county in the near future.

That part of Allegheny county between the Allegheny river on the north and the Monongahela and Youghiogheny rivers on the south and east, originally had a coal area equal to about one-fourth of its entire extent, the larger part of which has been mined. This field, or portion of the field, consisted principally of small bodies of coal lying high in the hills with an overlying strata seldom more than 100 feet in thickness and averaging perhaps 60 feet. A number of these detached bodies lay in what is now the city of Pittsburgh; those in the city limits, however, are nearly all exhausted.

The principal operations in the field north of the Pennsylvania Railroad have been those of the New York and Cleveland Gas Coal Company. The territory through which its operations extend has been quite a large one, and the systematic manner in which its coal has been mined has been remarkable as compared with other operations under similar conditions. That part of this field lying between the Pennsylvania Railroad on the north and the Monongahela river on the south, was quite a small one, and has been practically all mined out by two companies; W. H. Brown & Co., from the river front, and one mine on the Pennsylvania Railroad, near Wilmerding station.

That part of Allegheny county south of the Ohio river and north of the Pittsburgh, Cincinnati, Chicago, and St. Louis Railroad has from one-third to one-half of its area underlaid with the Pittsburgh coal bed.

The principal operations in this field are from the Montour's Run Railroad mines, and two or three mines on the Pittsburgh, Cincinnati, Chicago, and St. Louis Railroad. This coal also lies high in the hills with light overlying strata. This is practically yet a solid field, the coal that has heretofore been mined comprising but a small portion of the whole.

That part of the county lying between the Monongahela and Youghiogheny rivers was almost entirely underland with coal, about one-third of which has been mined. This field generally lies from 100 to 200 feet above the river, but the hills rising abruptly back from the river, have given it a thick over-lying strata. This field is at present the seat of the principal operations of W. H. Brown's Sons, Horner & Roberts, and a number of small operators shipping their coal by river, and of the properties of W. L. Scott, from which shipments are made by rail.

This field has been, and will probably continue to be, one of the most valuable in the district owing to its natural advantages both for mining and shipping of coal.

The remaining part of the county lying south of the Monongahela river and P., C., C. & St. L. Railroad, which comprises one-half of the county, is underlaid with the Pittsburgh bed of coal, substantially throughout its entire area, with outcroppings on river and railroad of nearly 100 miles. This field has its outcrop always at a sufficient height above the river and railroad to make it convenient for operating.

The mining and shipping of coal has always been divided into two methods—that of shipping by rail, and that by river, but the river operations are by far the elder, as they date back some 60 or 70 years.

The mines on the river are classed in what is known as "first," "second" and "third" pools—that is, all lying below Lock No. 2 on the Monongahela river are in the first pool, and those above, and on that part of the Youghiogheny that is navigable, as the second pool, and all lying between Locks Nos. 3 and 4, the third pool. The front hills, as they are usually termed, meaning those adjacent to the river, are very high and bluff, the coal outcropping near the tops of them. In these hills the first mining operations were conducted, and, indeed, it is only within the present decade that the operations have been extended into the second range of hills.

Mines in the first pool now in operation are those of Keeling, Walton, Castle Shannon, Hay's Estate, Rishers, and Munhall's. Nearly all of these mines are old ones, and their operations are being conducted at from 2 to 4 miles from the river front, the coal being hauled either by locomotive or wire rope. These mines still have a large and almost unlimited field of coal back of them, and they will be enabled to continue in operation for many years to come.

The mines in the second pool on the west side of the Monongahela river have not nearly the quantity of coal back of them that those in the first pool have; many of them are already worked out, their field of coal being cut off by the "creek outcroppings," a short distance back from the river.

The mines which are known as railroad mines are mostly located on the P., C., C. & St. L. R. R., several are on the Wheeling division of the B. & O. R. R., the New York and Cleveland Coal Company's in the Allegheny Valley, Pennsylvania and Montour Run Railroads, and W. L. Scott's mines on the P., McK. & Y. and the P., C. & Y. R. R.'s. Nearly all of these mines, with the exception of those located on the P. R. R., and Allegheny Valley Railroads, have an unlimited coal area to draw from.

Of the early mining operations in Allegheny county but little of good can be said, as the coal lies high in the hills with outcroppings on every side, natural drainage was almost always to be had, and the coal having to be hauled but a very short distance to the pit mouth, the need for scientific or economical mining was not felt. The sale of the coal always yielded a large profit, no matter how much it cost to mine it. During these early operations, disputes between the operator and miner in regard to the wages to be paid were constantly occurring, but there was seldom any effort made to economize in any other direction.

The mines were all worked on the single-entry system, and usually with only a single main entry, and air courses were even driven as far apart as possible, 300 or 400 yards sometimes intervening between them. No care was taken in the driving of rooms as to the width of the room or the thickness of the pillar.

Entries were seldom driven straight, and the entry pillars were left as small as possible. No one ever dreamed of making a "cut through" from one room to another, and ventilation in 90 per cent. of the mines was "natural," exclusively.

The supply of timber to the miner was limited, through a false notion of economy, in consequence of which large bodies of coal were lost in almost every mine, for the loss of 5 or 10 acres of coal that perhaps had cost the operator, when developed, from $600 to $800 per acre, did not trouble the superintendent or pit boss at all, and rather than put in a pump or a limestone drain, 10 or 15 acres of coal would be abandoned

forever, and the advice of a mining engineer was seldom asked, for the certainty that if the entries were driven far enough they would come to daylight was deemed sufficient.

Firedamp was seldom met with and never in dangerous quantities, and if occasionally the mine boss would decide to drive an entry to hit a certain point or an air course, sometimes he would do it by "sound," (mostly bad) guessing, and sometimes he would call in a surveyor.

Occasionally an operator, curious to know how much coal he had remaining unmined, would employ a surveyor and have a map made, and such a map! Often the entries only would be shown and sometimes the rooms would be indicated by a straight dotted line at right angles with the entry with the distances indicated in rods; and the mining out of other people's coal was the rule rather than the exception, for sometimes the coal from an entire tract would be taken without the owner's knowledge or consent.

Accidents were frequent, not from machinery or explosive gas, but from falls of coal, etc., and from narrow entries.

No business could have been more chaotic than that of mining coal in Allegheny county 20 years ago. The average output of the mines of the district was probably about 5,000 bushels a day for each mine, or about 200 tons. There were required from 30 to 50 cents per ton for expenses, outside of that for mining, and yet the margin was large enough to make the business immensely profitable.

It would be difficult to trace each step that has been taken towards improvement, but the greatest of them probably dates from the taking effect of the bituminous mine act of 1885, the operators being compelled by the provisions of that act to introduce some sort of ventilation into their mines; following this, the increased product consequent upon numbers of new mines being opened, and the increased competition where before there had been none, tended to set the operators to thinking how their coal could be handled more economically outside of the cost of the actual mining, and wire rope haulage was rapidly introduced, until now few mines that have been worked for many years are operated without it.

The "double-entry" system came next; and what a hard task it was to persuade the operators and mine bosses that it was not going to be twice as expensive as the old single-entry air-course system was, without any advantages over it. But it was accomplished, and is now in almost universal use. Next came "fan ventilation," and the scrupulous mining of every ton of coal that was contained in an acre.

It was the prevailing idea among coal men that the average quantity of merchantable lump coal to the acre was 80,000 bushels. The writer well remembers an occasion when a number of reputable operators and superintendents testified that not more than 90,000 bushels to the acre could be taken out, which was very probably true at that time; but now in our best mines the yield per acre is from 110,000 to 116,000 bushels, and in some cases as great as 120,000 bushels of lump coal over an inch and a half screen. In one year's work, in a large mine, the writer estimated that not more than 1 per cent. of coal remained unmined—a result hardly obtainable in any other vein of coal in the world.

The mining act of 1885 was certainly a great benefit to the operator as well as to the miner, as it started the weeding out of the old and ignorant class that had ruled the mines for so many years. How much the operator of this district left to the mine boss; for the operator, seldom having any knowledge of practical mining himself, he felt that the mine boss who had been in his employ for so many years, and had never yet failed to get out the few thousands of bushels of coal that was expected to be produced, knew all about it and must be, of course, a first-class mining man, no matter how grossly ignorant he seemed to be, but the "certified mine boss system" has to a certain extent done away with this class and it has also led to reading, study, and inquiry by many of the miners who aspire to the position of mine boss or fire-boss and consequently to the general promulgation of mining information amongst the miners and others connected with the mining of coal.

The present condition of the mines and mining in Allegheny County may be summed up as follows:

First. As to their sanitary condition, 15 years ago, perhaps 80 per cent. of them were very poorly ventilated, now 80 per cent. are well ventilated and the drainage has also been greatly improved, and the Allegheny county mines, as regards the health and safety of the miners, are above he average.

The principal cause of accidents is from falls of roof, no marked decrease in such accidents is apparent; this is a matter which now lies almost entirely with the miner himself, for the operator furnishes him with an unlimited supply of timber, but he does not use it.

Second. As to the production of coal in large quantities by the mines, there are at present about eighty mines in the county shipping coal either by river or rail, of these about half have wire rope haulage plants in operation, and coal is being produced and hauled in some cases several miles underground at from 5 to 25 cents per ton, exclusive of the price of mining, and it is often produced the cheapest where the longest haul is necessary, and haulage has been reduced to a minimum in probably 50 per cent. of the mines, in many of the mines in the county, however, it is crude and expensive.

Third. Improvements in the mining of coal. While the system of entries has been exchanged from the single to the double, yet the old system of room and pillar which has always been in use in this district has undergone no change, nor has anyone attempted to make what might be called an improvement on it; the rooms are usually 21 feet wide and ribs 12 or 13 feet thick, the coal is all taken out, but what a fortune in timber is buried each year in our mines! Occasionally some person who has a mine in leased coal and has no conscience as to the quantity of coal that is destroyed, tries driving rooms with the road in the center, "gobbing" both sides and burying the rib, this is not often done however.

No reliable experiment has ever been tried, to the writer's knowledge, to operate by any of the systems of Longwall, or to introduce any system which would economize in the timber supplies that are now wasted.

While the improvements noted have been the rule, yet there are quite a number of operators who are living and endeavoring to grow rich under the old order of things, and they will only reform when the heavy hand of the law compels them to use first-class appliances which will necessarily call for the employment of first-class men.

The Field of Electricity.

Mr. F. S. Terry, reviewing (in the Chicago *Daily News*) the progress of electricity for the past year, says that while electrical people can feel reasonably well satisfied with the progress of business during the last year, it has not been as great as was hoped for, nor as the earlier months gave promise of. This is largely due to the fact that during the last year electricity has not been used as much as heretofore in booming the growth of many of our Western towns. This, taken in connection with the constantly increasing numbers of those who have come into the electrical field, thereby largely increasing competition and reducing profits, has aided to retard somewhat the growth of the business for the last year, and has made the results rather disappointing.

Many of those who have gone into the business have been more or less irresponsible, and have labored under the additional difficulties of lack of business training and experience. I do not know of any line of business that demands these qualities to a greater extent than do the electrical industries. The fact that many of these people have ultimately failed has not had a stimulating effect, as the prices that they have established have remained in force.

The phenomenal growth of incandescent lighting is an evidence, however, of its increasing popularity. It seems to me almost an established fact that in a few years incandescent lighting will be practically general, while the older forms of illumination will be things of the past. Just as candles and oil have been superseded by gas, so electricity will succeed gas. Water gas is more or less poisonous in its effects, while illuminating gas is more or less unhealthful, as the oxygen of the air is rapidly consumed. Besides this, the flame in time will blacken walls and decorations, while the actual amount of light returned is very appreciably less than that afforded by the electric lamp.

These facts, perhaps, are not thoroughly appreciated by any save those who have been accustomed to gas, who have then used the electric light and ultimately returned to gas. Those that pursue this course are positive grumblers at the inefficiency of gas light, while you will find them most enthusiastic over the electric light.

The fact of the matter is that electricity costs but little more than ordinary gas, while there is no oxygen consumed, no blackening of walls and decorations, and the little key in the socket is always near at hand and light can be turned on at any time. Of course, without the use of matches the danger of fire is reduced to a minimum. With the increase of personal safety and the large amount of light returned in excess of gas, it seems to me almost incredible that the universal adoption of the incandescent lamp should be a matter of more than a few years. I believe that gas will soon cease to be used as an illuminating agency, and be confined to fuel purposes exclusively.

In fact, to sum up, there is every reason why electricity should be used, and no really plausible reason why it should not be. With the adoption of the electric light there is another possibility which promises to be almost as extensive in its use as the incandescent lamp. I refer particularly to electric power as obtained from motors. You will

remember the large number of little fan motors that have been used in almost every office during the last year or two. The same principle has been applied to larger motors, some of which have been constructed for 1,000 horse power. In fact the range of these motors runs from that of a 100 horse power to a thousand. I predict that it will be but a few years before you will see all the power in a number of large cities disseminated from the central station, while the mills, machine shops and factories will each be operated by an individual motor.

As demonstrated by results, it is impossible for electricity to grow in any one special direction unless in all. This fact you will find exemplified by the growth of such articles as are used in domestic electricity. By this I mean especially bells, batteries, annunciators, burglar alarms and kindred articles. I will venture to say that out of every hundred houses being erected, 75 per cent. are wired for annunciators and bell calls, as well as for electric gas lighting, in those localities where for various reasons it has been inconvenient to put in the regular incandescent lamp.

Of the electric railway it is hardly necessary for me to speak, and were you to take a tour through any of our states you would find that in large numbers of the cities, even down to those having only 10,000 inhabitants or so, the electric railway has superseded the horse road. It has been found that better service is obtained, quicker time made, and at a greater economy than under the old system. I might add that the prospects for the installation of electric railways during the coming year are simply enormous. I know of small towns that have not heretofore been able satisfactorily to support horse roads that are putting in electric systems. The better service afforded induces increased local patronage, and roads that under the old system were steadily losing money are paying satisfactory dividends by the use of electricity.

As to the electrical supply business, it seems at present that there is a movement toward centralizing in a number of large houses. The vast number of articles that it is necessary to carry in an electrical supply stock involves a large amount of capital, and for this reason the smaller concerns appear to be dropping out of the business.

I am justly enthusiastic on the subject of electrical growth, and until some more economical agency can be found to take its place electricity offers every evidence of becoming universal in its applications, from the tiniest household convenience to the largest enterprise to which power is applicable.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At a recent meeting of the Board of Directors of the Delaware (O.) Gas Light Company, Mr. T. C. Jones, Jr., was elected General Superintendent of the Company. Mr. Jones was for several years with the Delaware Company, as assistant to Mr. C. M. Converse, and was also a student under Mr. Emerson McMillin, at Columbus, O. He is energetic and enterprising, and is thoroughly in touch with his profession.

Mr. D. T. Roots, that bundle of nerves and activity who signs himself President of the P. H. & F. M. Roots Company, of Connersville, Ind., writing to the Journal under date of the 7th inst., says: As it is the beginning of the new year we thought you might be interested in a slight review of our past season's work. While it has been a quiet year in the gas business generally, yet we feel we have reason to congratulate ourselves, as we have increased our annual output about 25 per cent., and the prospects for 1892 are very bright. We have on our books orders from Messrs. Bartlett, Hayward & Co. for two exhausters, with engines combined on same bed plate, each machine to be of the capacity of 3,500,000 cubic feet per day; also for two No. 6 blowers, with engines combined on same bed plate. These machines are for the Nassau Gas Light Company, of Brooklyn, N. Y. We are under contract to furnish the Niagara Falls Gas Light Company with a No. 1 exhauster; also a No. 3, to be forwarded to the Selma (Ala.) Gas Light Company. Some of our principal shipments for the last year were as follows: Helena (Ark.) Gas Light Company, one exhauster, capacity 100,000 cubic feet per day; Dallas (Tex.) Gas Light Company, one exhauster and engine combined, with gas valves, governor, etc., capacity 600,000 feet per day; Peoria (Ills.) Gas Company, one exhauster with engine combined on same bed plate, with 16-inch gas valves, pipe fittings, governor, etc., capacity 2,000,000 feet per day; Bristol, Tenn. (to the order of Bartlett, Hayward & Co.), one exhauster and engine, capacity 100,000 feet per day; Newark (N. J.) Gas Light Company, two exhausters and engines combined on same bed plate, with bye-pass, gas valves, etc., capacity of each, 2,000,000 cubic feet per day; also, for same place, two No. 4 blowers and engines combined—the Newark orders were at the instance of Bartlett, Hayward & Co.; Mutual Gas Company, Savannah, Ga., one exhauster and engine, capacity 900,000 cubic feet per day; Massillon (O.) Gas Light Company, one exhauster and engine combined, gas valves, governor, etc., capacity, 300,000 cubic feet per day; Michigan City (Ind.) Gas Company, one exhauster and engine, capacity 300,000 cubic feet per day; Memphis (Tenn.) Gas Company, two exhausters, with engines and governors, capacity 2,000,000 cubic feet per day; Alliance (O.) Gas Company, one exhauster, engine and governor, capacity 150,000 cubic feet per day; South Bethlehem (Pa.) Gas Company, one exhauster, engine and governor, capacity 600,000 cubic feet per day; Lansing (Mich.) Gas Company, one exhauster, engine and governor, capacity 300,000 cubic feet per day; Logansport (Ind.) Gas Company, one exhauster and engine combined, capacity 150,000 cubic feet per day; Kerr Murray Mfg. Co. (Fort Wayne, Ind.) ordered two exhausters and engines combined, capacity of each, 300,000 cubic feet per day; Standard Gas Company, N. Y. city, one exhauster and engine combined, pipe fittings, gas valves, etc., capacity 3,500,000 cubic feet per day; Elizabethport (N. J.) Gas Company, one exhauster, capacity 900,000 cubic feet per day; Hoboken (N. J.) Gas Company, one exhauster, capacity 900,000 cubic feet per day; Toledo (O.) Gas Company, one exhauster, capacity 2,000,000 cubic feet per day; Paris (Ills.) Gas Company, one exhauster, engine and governor, capacity 100,000 cubic feet per day.

Trusting we will not take up too much of your valuable space, and thinking you will agree with us that we have made a good showing during the year, we remain, Yours, etc.—The P. H. & F. M. Roots Co.

President Roots will have to give us a harder one than that before he obliges us to "give it up." What else can we do but agree with him. It is a showing that ought to make the shareholders in the Company believe that their old pocketbooks will have to be exchanged for larger ones. It also goes to show that our electrical friends are not making any nearer approach to that day when gas lighting is to be a thing of the musty past than they were 10 years or more ago, when their slogan to that effect was shouted. On one point, however, we must disagree with President Daniel, and that is with respect to the average dullness of the iron trade for the past year. Generally speaking the iron trade may have been quiet but not so in respect to that division of the iron workers whose goods are taken up by the gas makers. In fact from the advices we have as to that department of iron working, this has been the briskest year enjoyed by them for at least a decade.

An analysis of the Root Company's figures shows that 22 Companies have made provision for leading into their finishing apparatus a quantity of gas equal to a make of 28,300,000 cubic feet per diem. Of course, it is understood that these quantities are not likly to be reached at once, but the provision shows that those in charge of the plants are satisfied that the attainment of that maximum is only a matter of time—in fact in some instances on the list above named, it is but a question of comparatively short time.

At the annual meeting of the shareholders in the Brooklyn (N. Y.) Gas Light Company the following Directors were re-elected: H. D. Polhemus, H. K. Sheldon, A. M. White, Henry H. Rogers, E. H. R. Lyman, Frank Lyman, Alexander E. Orr, W. C. Cary and C. W. Blodget.

Mr. John B. Varick has been elected President of the Peoples Gas Light Company, of Manchester.

We understand that Mr. L. A. Rowell will, under the counsel of Mr. J. R. Farnum, have charge of the gas works at Vineland, N. J.

Some two or three years ago the authorities in control of public matters along the North Shore of Staten Island made up their minds that incandescent electric lamps would answer more satisfactorily the needs for public lighting than any other medium that had been tried in the Kingdom of Mr. Wiman. In due time a contract was made with the Richmond Light, Heat and Power Company and a number of so-called 20 candle power incandescents were put into commission. The service so rendered was never very inviting, but from indifference it lapsed to inefficiency and later on to worthlessness. At least such we must infer to be the case since the papers (who by-the-way were very pronounced at the outset in their opinions that incandescent electric lamps would be many times superior to the gas lamps that they were to replace) and the people have complained long and loud over the poverty of the lighting—in fact the utter lack of lighting that was their portion, and for which they were being heavily taxed. About a fortnight ago the complaint became so general that a special meeting of the Board of Trustees, of Edgewater, was called to consider a formal complaint from Mr. James McNamee, who made a series of specific statements about the

failure of the lamps and the as good as failure of those that were supposed to be shining. The Board admitted that Mr. McNamee's complaints were well-founded, whereupon, at the instance of Trustee Brady the following resolution was unanimously adopted :

"*Resolved*, That the lighting of the streets by the Richmond Light, Heat and Power Company is far from being satisfactory, and shows either poor management on their part, or a want of force or power to make sufficient electricity to supply the village, and that the Company be notified that if they cannot fulfill their contract better than at present the village will be obliged to find other means to light the streets."

THE resolution, though homely enough in its wording, is sufficiently forceful to show that Edgewater suffers, as to its public lighting; but this is not to be wondered at, for it is without our knowledge where any example of outdoor incandescent electric lighting has answered the purpose, either in respect of efficiency or economy, which it was intended to serve.

THE Directors of the New Haven (Conn.) Gas Light Company have re-elected the following officers: President, Daniel Trowbridge; Secretary, Gardner Morse, Jr.; Treasurer, Isaac J. Wild.

ANOTHER chapter of promises unfulfilled in the instance of a municipal electric lighting plant, is afforded from an experience of the plant of that type in operation at Little Rock, Ark.—this place always figured in the statistics gathered by those who sought to favor the general adoption and working of electric lighting plants on municipal account as a model in point of equipment and as a marvel in the matters of efficiency and cheapness with which the lamps were maintained. Well, to make a short story out of a long one, the Council of Little Rock has been asked for an appropriation well up into the thousands, for the purpose, as those who asked for it said, of "renovating and increasing the power of the present city electric lighting system, which is now thoroughly proven inadequate to the city's needs;" and "that there is too much demand on the power at the dynamos for the number of lights in use. Because of this the city gets very poor lights, and even obtains those only at irregular intervals." The opportunity for hindsight is now in the breach.

ACCORDING to a recent issue of the Wall Street *Journal*, the Laclede Gas Light Company reports that it sold in December last 100,792,100 feet of gas, an increase of 9,008,500 feet as compared with the same month of the previous year, and that the decrease in leakage was 7,700,000 cubic feet. The cash receipts were $119,464, an increase of $10,045. The net profits from the gas works were $68.823, an increase of $10,352. Other profits from electric and Pintsch works bring the total net for the month up to $74,985. Total earnings for the year were $582,460, an increase of $68,711. This increase also overcomes the loss of the city lighting of $100,000. The expenditure for permanent improvements of $45,000 was out of net earnings and charged to expense account. It would seem, however, that the net for December should show a greater gain than $10,045, when it is borne in mind that the natural increase in send-out was 9,008,500, and that a saving in leakage of close on to 8 millions cubic feet was a concomitant.

MR. E. C. FITZ, of Boston, has been elected to the vacancy in the Board of Directors of the Bay State Gas Company caused by the death of Mr. H. C. Gibson, of Philadelphia.

THE following output figures from the City Gas Works, Wheeling, W. Va., will be read with interest:

Month.	1889. Cu. Ft.	1890. Cu. Ft.	1891. Cu. Ft.
January..	12,500,000	15,064,500	16,817,000
February.	11,409,400	12,174,300	13,055,500
March....	11,267,600	12,511,200	13,197,000
April	9,302,300	10,557,000	10,932,000
May.....	8,296,700	9,018,200	9,777,560
June.....	7,115,500	7,991,800	8,292,000
July.....	6,172,000	7,071,000	8,414,500
August...	7,059,500	7,771,000	8,397,500
September	9,475,000	10,752,000	11,445,500
October...	12,679,200	13,406,000	14,402,500
November	15,145,300	14,993,000	16,472,500
December.	16,239,300	17,168,000	18,000,000
Total...	126,661,800	138,478,000	149,198,560

SECRETARY KELLER and his brother officials of the Columbus (Ind.) Gas Light and Coke Company are amused spectators at the plight in which the city authorities have involved themselves over that celebrated municipal electric lighting station. Not two years in operation, and it has virtually to be reconstructed!

COUNSEL for the bondholders of the Merchantville (N. J.) Gas Light Company recently made application before Vice-Chancellor Green (Camden) for the appointment of a receiver to take charge of the affairs of the Company. He stated there was a mortgage against the Company for $28,000, that the Company was insolvent, and that the principal source of its revenue was a contract to light the streets of the borough of Merchantville. By consent of both parties to the argument, Mr. Charles E. Zane, of Merchantville, was appointed receiver, and he was authorized to issue $2,000 worth of receiver's certificates, giving the certificates-holders the first lien on the property, which at sale, it was stated, would not bring more than $15,000.

AT the annual meeting of the Batavia (N. Y.) Gas Company the following officers were chosen: Directors, Henry Craft, John P. Casey, R. L. Kinsey, O. C. Steele and Chas. H. Caldwell; President, Henry Craft; Vice-President, John P. Casey; Secretary and Treasurer, C. H. Caldwell.

GAS INSPECTOR GALPIN, of Chicago, has recommended to Councils the construction of 14 iron tanks, each to have a capacity of 600 gallons, in different parts of the city for the purpose of storing gasoline for the street lamps of that type with which the suburbs are illuminated.

RECENT advices from Nashville, Tenn., are to the effect that the gas and electric light plants, formerly under control of the City Illuminating Company, of Murfreesboro, Tenn., have been purchased, and will hereafter be operated, by Mr. A. W. Kissam, of New York. The consideration is put at $30,000. The new management will make some changes in the plant system.

MR. EDWARD G. SMITE, of Scranton, Pa., formerly on the engineering staff of the Delaware, Lackawanna and Western Railroad, has accepted a responsible position at the Irwin, Pa., mines of the Westmoreland Gas Coal Company.

THE Fitchburg (Mass.) Gas Company's regular semi-annual dividend of 5 per cent. has been declared.

We are indebted to Mr. Charles F. Prichard, General Superintendent of the Lynn (Mass.) Gas and Electric Light Company, for the following particulars respecting the suit recently brought by his Company against certain insurance companies to recover on policies issued by the latter in protection of the former's plant. Thanking Mr. Prichard for the courtesy shown us, and congratulating him upon the outcome of the suit, we submit the following :

"To the Editor AMERICAN GAS LIGHT JOURNAL: The item * you published in the last issue relative to our fire loss is so far from the truth that I send you this morning (Jan. 12) further information relative to it. It had, you will note, no connection with the gas works, but was in our electric station. There was no 'explosion' in the sense usually meant, but rather a fire which short-circuited our circuits, throwing a heavy load upon shaft and pulleys that broke them, ending in a general smash along the line of shafting and breaking the big fly wheel. Had loss occurred by explosion the Massachusetts standard policy would not have protected us—explosion meaning there the form usually taken by powder, dynamite, etc. Our direct damage by fire was about $1,100; the indirect loss was about $9,100. We claim that our loss was as directly a loss by fire, as if the fire had burned away the supports of the roof, for instance, and the roof, falling, had crushed everything below. The fire took away from the engine its load and its power of control, and was the direct cause of the disaster."

THE further information forwarded by Mr. Prichard was contained in a report of the trial published in the Lynn *Item*, from which we republish the following extracts: "A verdict for the plaintiff was rendered at the Superior Court in Salem, in the suit brought by the Lynn Gas and Electric Light Company against 23 insurance companies. The direct suit was brought against the Meriden Insurance Company, of Connecticut, and 22 others. It was one of the most interesting cases ever entered in the Massachusetts courts, and promises to become a celebrated case in mechanical circles. A question of liability for loss caused by the breaking of machinery and subsequent damage to building had arisen and, while the insurance companies admitted liabilities for damages caused by immediate contact with fire and water, they have re-

* See JOURNAL, *ante*, p. 47.

fused to admit responsibility for the loss occasioned by the breaking of machinery. The case consumed eight days at the Superior Court, and was bitterly contested by the insurance companies, who called to their assistance Solomon Lincoln, of Boston, the able attorney of the Boston and Maine Railroad, and noted experts from New York, Boston, Providence, Manchester and Lynn. The affairs of the Lynn Company were looked after by Niles and Carr, assisted by District Attorney Moody, of Haverhill * * * It will be remembered by every reader of the *Item* that one night in October, 1890, while the machinery was running as usual in the electric lighting station, on Pleasant street, a slight fire was discovered in the tower of the power house, where the wires are led out to the main circuit. Within a very few moments, through a derangement of the wires, a rupture of the machinery and breakage of the fly wheel resulted, causing a very considerable amount of damage. It was admitted by all parties concerned that there was no burning outside of the power house, and that the total damage by actual fire was less than $1,100. But the Lynn Gas and Electric Company claimed that the rupture of machinery and breakage of the fly wheel, causing a damage of over $9,000, was the indirect result of the fire and that, therefore, the fire insurance companies in which it held policies were responsible. Counsel for the Lynn Company argued to the Court that the fire in the tower, by bringing the lighting arresters into contact, or by creating a short circuit, caused instantaneous and excessive changes of load on one of the pulleys weighing 1,000 pounds, leading to the breaking of that and connecting pulleys and other machinery of transmission, and ultimately to the breakage of the immense fly wheel, from which the principal damage resulted. The defense claimed that the fire in no way caused or contributed to the wreckage of the machinery or the building. They argued that the belt from the governor to the engine was too loose or was in some other way defective, so that the engine attained a dangerous speed, and not only caused fire in the tower by overloading the wires, but also caused the rupture of the wheel and other machinery by centrifugal force. There was no question as to the claim for damage set up by the parties in interest. The only question for the Court to decide was as to whether the plaintiffs should be given $1,100, the amount resulting from direct damage by fire and water, or the $9,100 claimed for wreckage of the building and machinery. * * * The jury returned a verdict for the plaintiff of $9,165.44."

Justice Barrett, in Supreme Court Chambers, N. Y., on the 11th inst., granted a temporary injunction, asked for by Martin A. Frank, restraining the Edison Electric Light Company from declaring a dividend of 80 per cent. by issuing debenture bonds. Justice Barrett in allowing the injunction said: "Of the inherent illegality of the proposed scheme I have no doubt * * *. Upon what principle can a corporation issue its bonds in order to raise money to declare dividends? That is simply borrowing money for the purpose contemplated * * *. If the bonds are not paid at maturity, and the securities are insufficient for their liquidation in full, the Company will be liable for the deficiency. That deficiency may impair or may wipe out the capital."

The New York *Tribune*, of January 12th, says that a suit was instituted the day before, in the Court of Common Pleas of this city, against Wallace C. Andrews, ex-President of the Standard Gas Light Company, to recover $9,580, the commission for the sale of certain stock to the late B. T. Babbitt. The papers allege that Mr. Andrews, while he threw off $5 per share on the preferred stock, sold Babbitt the common stock of the Company at $20 a share above the market value. The suit will determine the ownership of the stock sold Mr. Babbitt, as there is some question as to whether it was the property of the Company or the individual asset of Mr. Andrews, a matter in which the stockholders evidently have some interest. The complaint alleges that the ex-President managed the sale with singular adroitness, that the broker had no knowledge of the real condition of affairs between Mr. Babbitt and Mr. Andrews, as the latter saw the customer alone, after the introduction by the broker, assuring him that whatever he did with Mr. Babbitt was all right; that it would not interfere with the broker's commission, but merely hung up the transaction. When the broker asked for his commission, Mr. Andrews replied that he did not think he (the broker) was entitled to any commission, as the transaction had been conducted by Mr. Andrews. The latter, when pressed for a reply, said he had only sold 1,000 shares of preferred stock to Mr. Babbitt, and that was sold at $95 per share. Under this representation the broker took $500 in settlement. Afterwards the broker learned that Mr. Baboitt had purchased 2,000 shares from Mr. Andrews—1,000 common and 1,000 preferred, and that he obtained from Mr. Babbitt the sum of $70 per share for the common—a rate said to be $20 per share over that then ruling in the market. The *Tribune* believes that this suit will be apt to determine other matters than the mere sale of the stock.

Mr. G. H. Brown, formerly of the Laclede Gas Company, and later of the Standard Company, of this city, has been appointed Superintendent of the Morristown (N. J.) Gas Light Company.

At the annual meeting of the shareholders of the Schenectady (N.Y.) Gas Light Company the following officers were chosen: Directors, Capt. W. H. White, Chas. Stanford and John McEncroe; President, W. H. White; Treasurer, John McEncroe; Secretary, Clement A. White. M. J. Leyden was re-appointed Superintendent.

Patrick McLaughlin, who for 41 years acceptably and faithfully served the Wilmington (Del.) Coal Gas Company, resigned his post on New Year's day, having determined to spend the remainder of his days in ease, a condition made possible by his carefulness in the past. About a week after his retirement he was somewhat surprised to receive a summons commanding his appearance at the works. His first feeling of surprise was only a zephyr compared with the gale that subsequently interfered considerably with his respiration. This asthmatic attack was caused by the presentation to him (by the veteran Superintendent, Mr. Thomas Curley) on behalf of those who he had labored amongst for many years of a handsome silver tea service, numbering 8 pieces. In fact, it was really hard to tell who of the two—the Superintendent or the ex-boss of the yard—was the most affected at the first blush of the affair; but it all ended happily in the sunshine of congratulation and acknowledgment.

At the annual meeting of the Paris (Ky.) Gas Company these officers were elected: Directors, John T. Hinton, Chas. Stephens, George Alexander, A. Shire and James K. Ford; President, J. K. Ford; Secretary, A. Shire; Treasurer, George Alexander.

President Livingston is authority for the statement that the St. Paul (Minn.) Company, in 1891, expended the sum of $312,000 for betterments, divided as follows: New buildings, $85,000; new gasholder, $150,000; new mains, $50,000; extensions to electric light plant, $27,000.

We understand that Messrs. A. A. Franzheim & Co., of Wheeling, West Va., have applied to City Councils, of Martin's Ferry, for the right to construct and operate a gas works there. This place, which is also known as Martinsville, is a village in Pease township, Belmont county, Ohio, located at a point on the Ohio river about two miles above Wheeling. Bituminous coal of fine quality abounds there, and it also is blessed with iron ore and limestone. It has several factories for working in iron, glass, farming implements, etc. Population, about 9,000.

An Odd Theory on the Production of Petroleum.

Professor Sickenberger, of Cairo, Egypt, has recently put forth a curious paper regarding a development of petroleum that he asserts is occurring at the present day, which seemingly goes to confirm the theories of Professor Ochsenius and others, that petroleum is derived from animal residues decomposing in very salt water. The Red Sea is, in Ochsenius' sense, an almost closed bay of the sea; there is no current in it, and the Suez Canal has exceedingly little influence upon its saltness, whilst the sweet water canal which supplies Suez with fresh water has an inappreciable effect. The entrance at Aden is narrow and very much blocked by islands, shallows and reefs, and coral banks, which last are constantly increasing. The Red Sea is the hottest bay of the Indian Ocean, and evaporation is rapid; and the consequence of all this is that it is exceedingly salt, while at the same time it remains rich in animal lfe. Many of the bays are perfectly tranquil and filled with life, of which there appears to be an over-production. The consequence is that when animals die they putrefy in warm salt water and produce a surface layer of petroleum, which varies in thickness in these bays from an iridescent film to a layer 4 inches thick. The percentage of salt in these bays is as high as 7.3. In this petroleum of the Red Sea there is a good deal of sulphur, and there is also a considerable quantity of sulphureted hydrogen. The coral deposits and soft chalks along the shore are soaked with this oil, which in some places actually collects and falls back into the sea; but the farther from the sea the less the oil, and there is none to be found where the rock ceases to be porous. All the chalk rocks round the Red Sea are also more or less bituminous. These facts have been long known, but their significance remained unappreciated until the new theory was launched. It has been attempted to explain them by volcanic action; but the geological facts will not fit this theory. There are no traces of plant residues found in the borings. In the Dead Sea the conditions must have been at one time similar; but now the water has become too salt, the animals are dead, and what we now get there is the petroleum of long ago in the form of bitumen. There is no trace of volcanic action in the neighborhood, but everywhere we find undisturbed tertiary and cretaceous rocks. In a lake without outlet, called Birket El Gurun, which is slowly becoming salter, there is abundance of life, mostly fish, which eat the lower forms when they die. The bodies of the lower forms do not accumulate as they do in the Red Sea, where the fishes are fewer in proportion; and consequently there is no petroleum produced.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

January 18.

☞ All communications will receive particular attention. ☜ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	102½	103½
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	123	125
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	120	122
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	38	42
Preferred	5,000,000	100	82	85
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	121	122
Citizens	1,200,000	20	97¾	98
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	134	135
" Bonds	300,000		102	—
Peoples	1,000,000	10	81	82
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	99	100
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	129	—
" Ctfs	700,000	1000	100	—
Williamsburgh	1,000,000	50	120	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	84	86
2d " " "	3,000,000	1000	70	74
Bay State Gas Co.—				
Stock	5,000,000	50	58½	60
Income Bonds	2,000,000	1000	98	102
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	76	76¼
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	87½	88
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	100	—
2d "	2,500,000	1000	96	—
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	7,000,000	100	—	200
Consumers Toronto	1,000,000	50	169	172
Central, S. F., Cal			90	—
Capital, Sacramento, Cal			58	
Consolidated, Balt	11,000,000	100	46½	47
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	180	200
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	22	22¼
Preferred "	2,500,000	100	59	61
Bonds	9,034,400	1000	83½	83⅝
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			34¾	35¼
Peoples, Jersey City		—	115	125
" " Bonds			—	—

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about 150,000 gallons per year, for a term of one, three, or five years. Delivery in tank cars, N.Y.C. & H.R.R.R. track, Fourth street. Proposals will be received until January 20, 1892, and should be addressed to

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Tenders will be received by

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until 23d inst., for their entire production of

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for one, two, three or five years from 1st of May, 1892. The Company does not bind itself to accept the highest or any tender. Full particulars to be had on application.

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Montreal, Can., Jan. 8th, 1892.

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THE PEORIA GAS LIGHT AND COKE CO.

Is now open to receive bids for its product of

Coal Tar for the Year 1892.

The tar is from the best quality of Pittsburgh coal, and the quantity made about 2,000 barrels. Bids to be per gallon in tank cars, Peoria, Ill., the tanks to be furnished by the bidder. Bids will be opened Feb. 1, 1892.

PETER COFFEY, Supt.

Peoria, Ills., Dec. 18, 1891. 864-6

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A Second-Hand Rotary Gas Exhauster,

With 6 or 4 inch connections. Mackenzie preferred. Address

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65 ft. diameter and 20 feet deep, with columns and girders. The holder is in a fair state of preservation, and could be taken down and erected in some small city or town.

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For the economical handling of Coal, Coke, Oxide, etc., in Gas Plants.

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NO EXTRA LABOR OR OPERATING EXPENSES.

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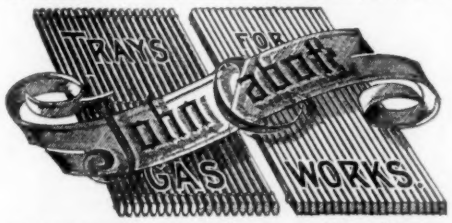

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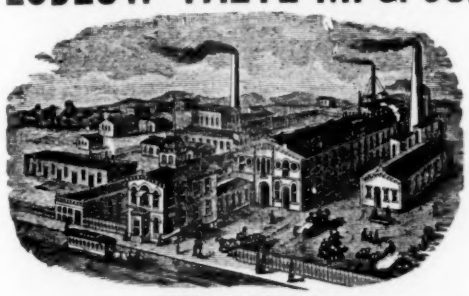

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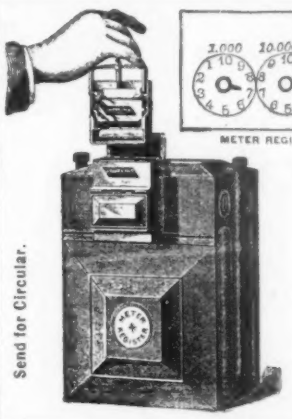

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Meter Reader does not have to use light or pen.
It is an absolute check against getting the readings crossed.
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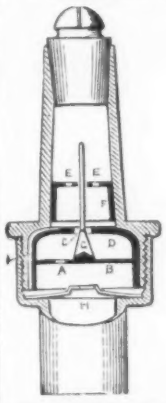

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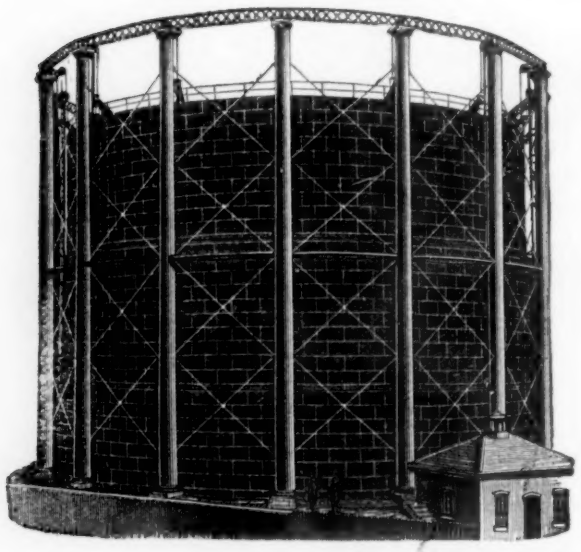

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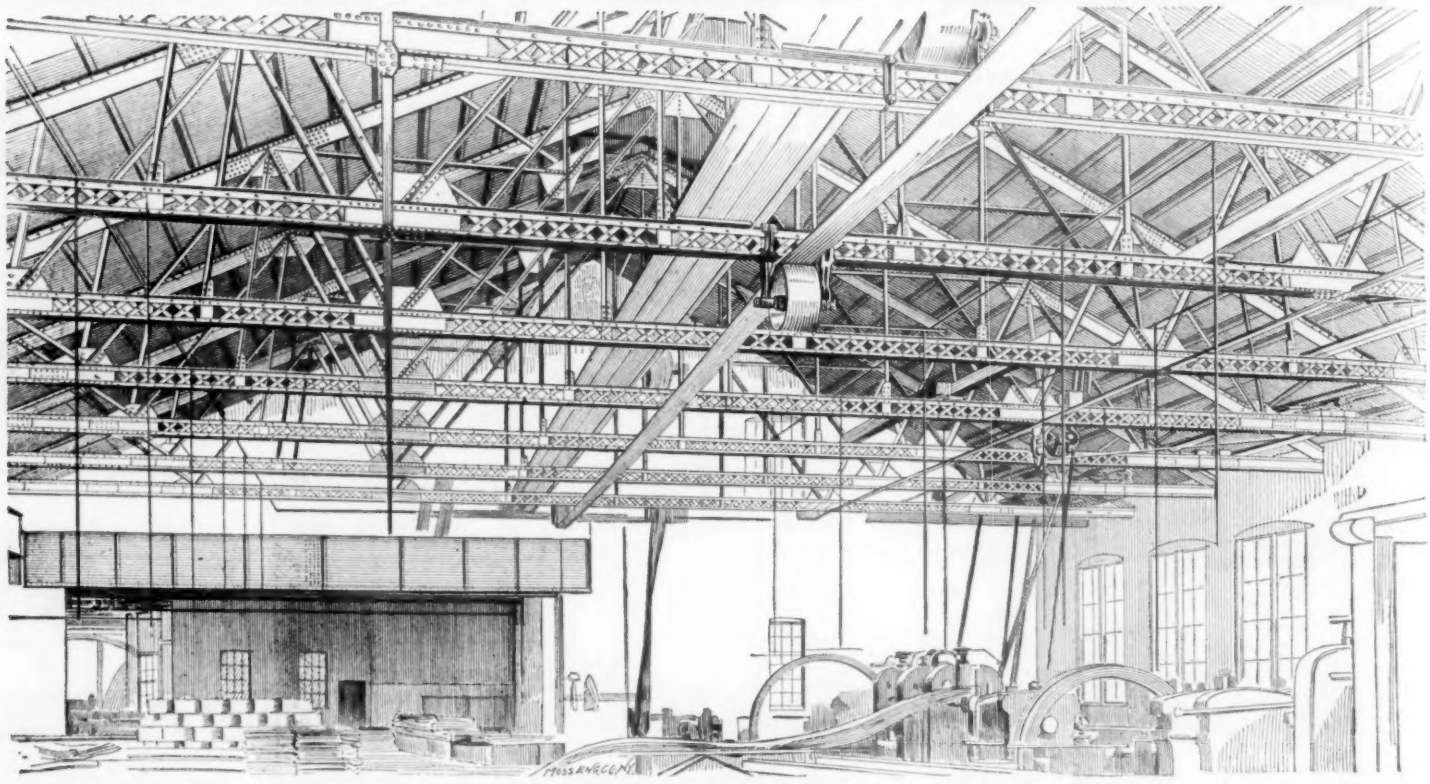

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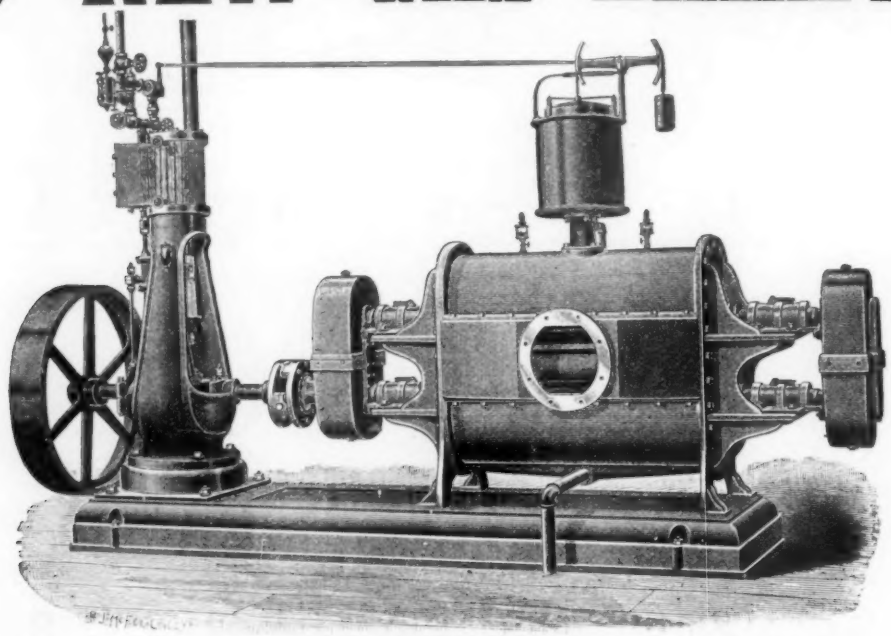

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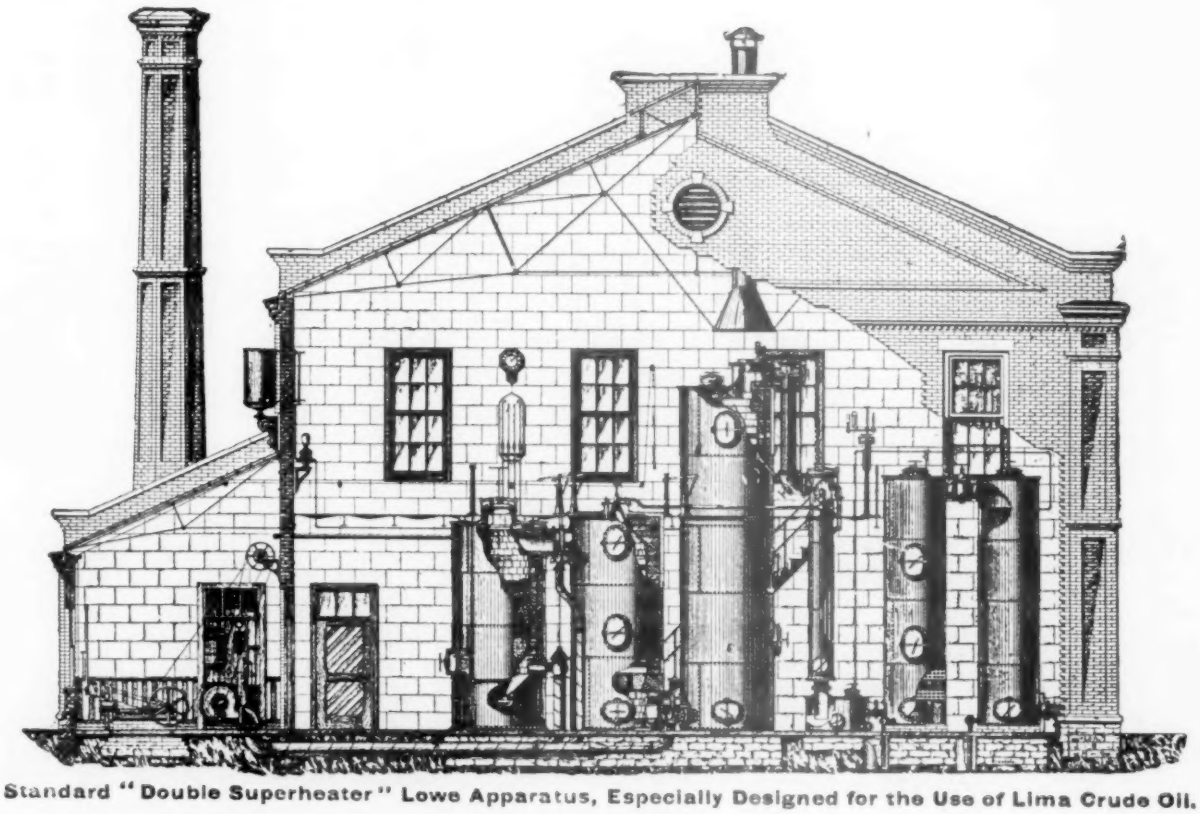

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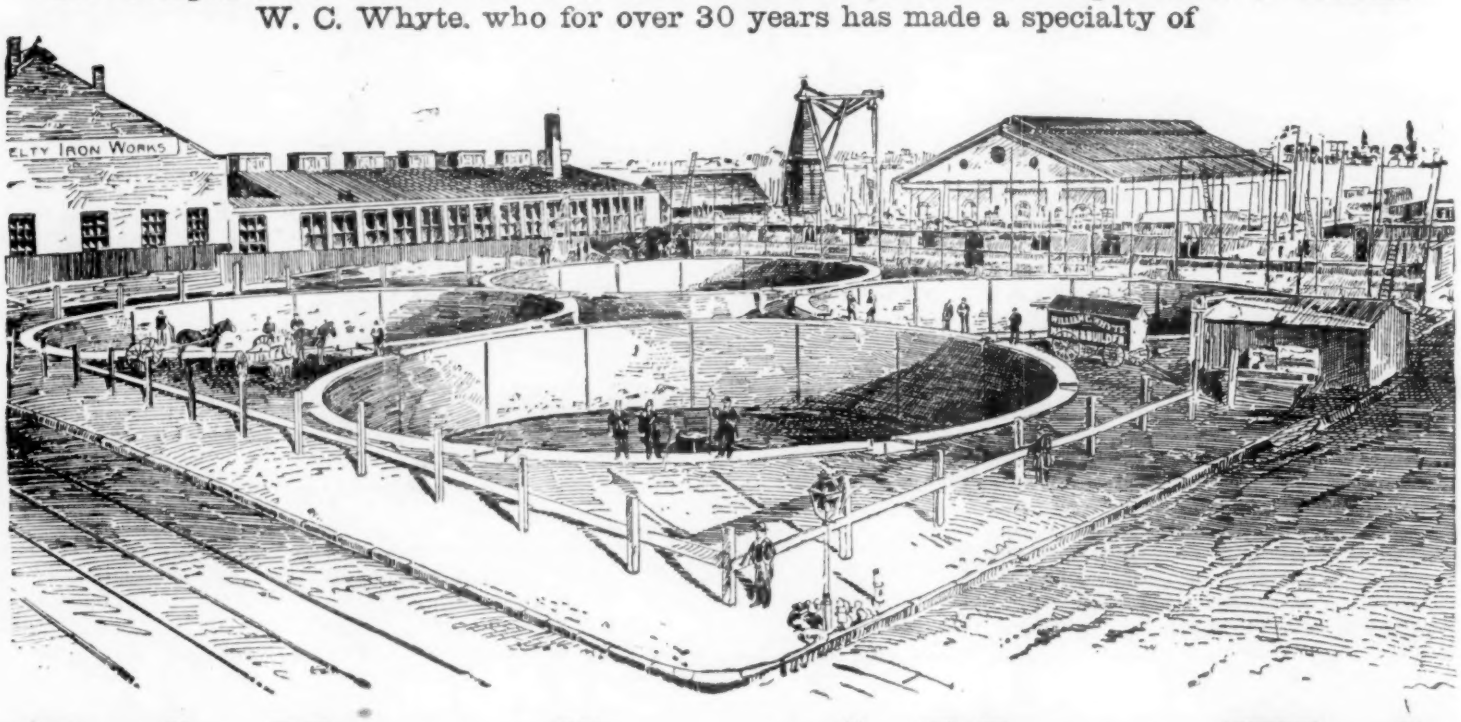

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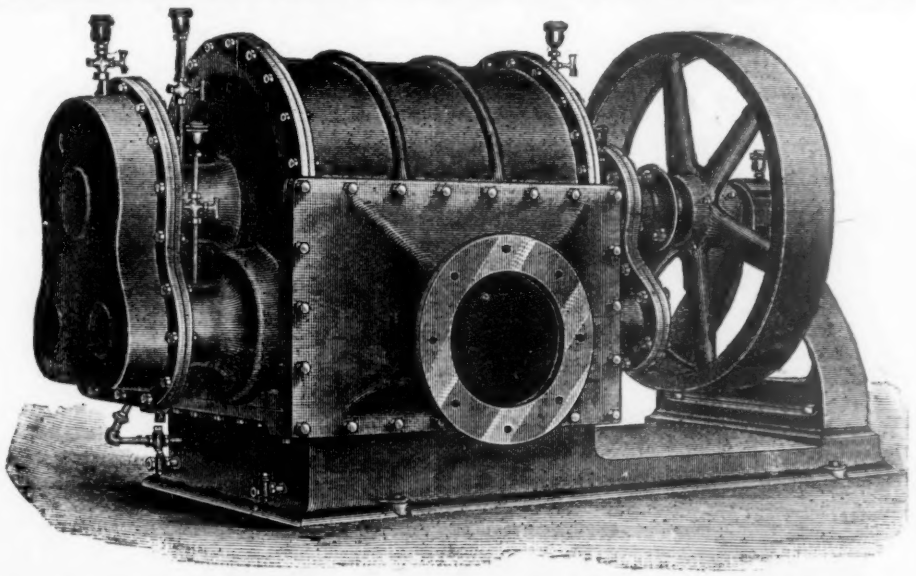

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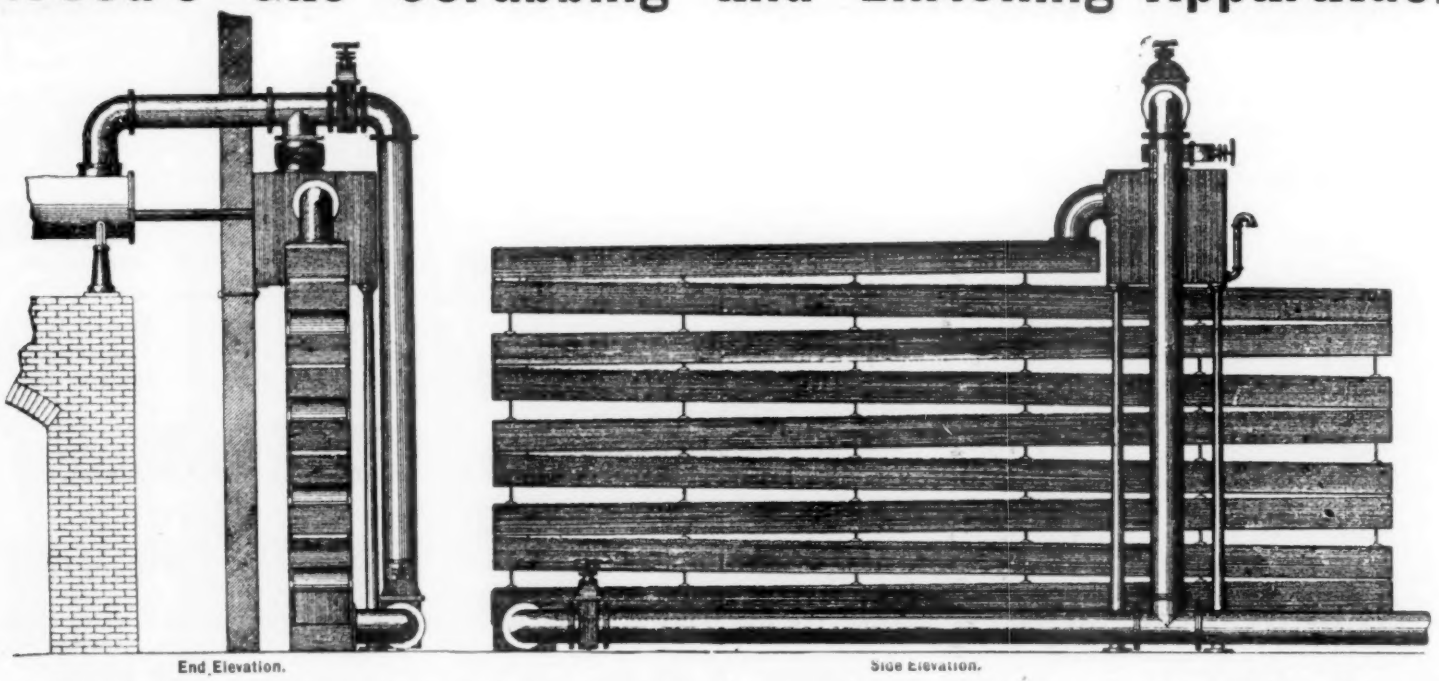

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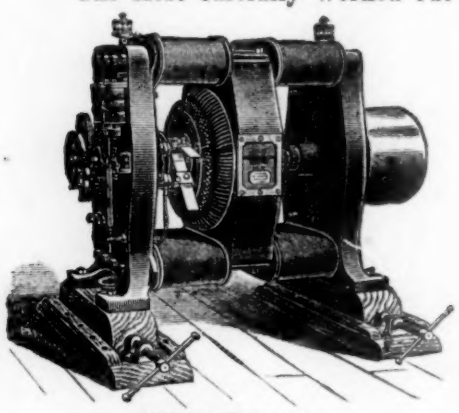

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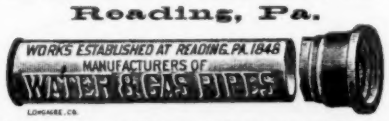

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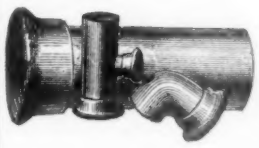

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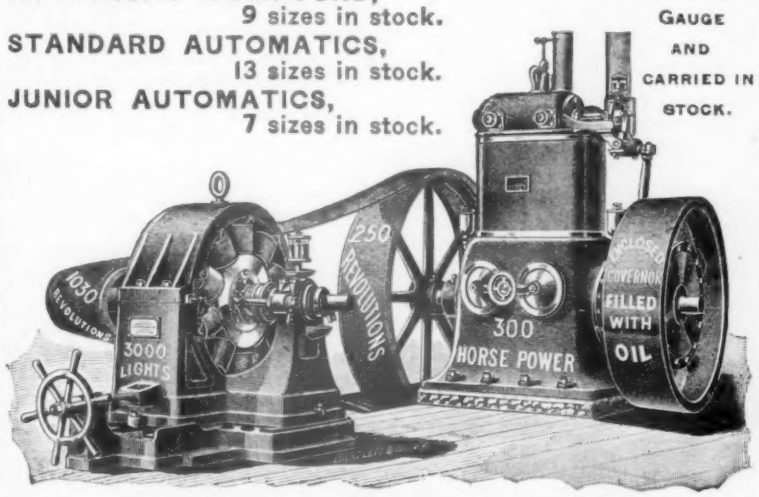

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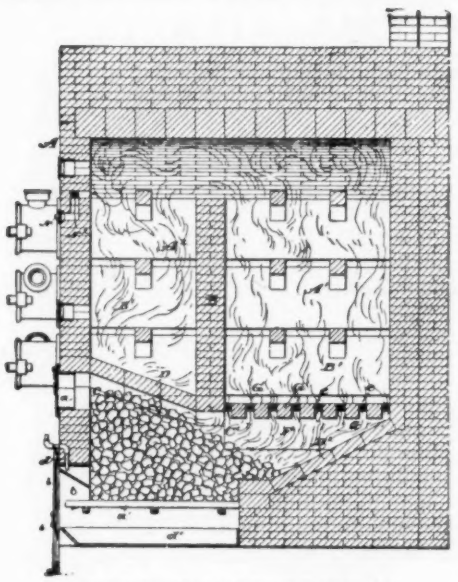

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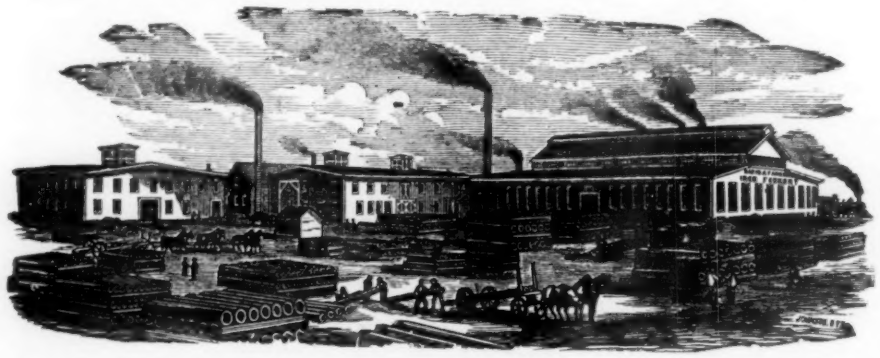

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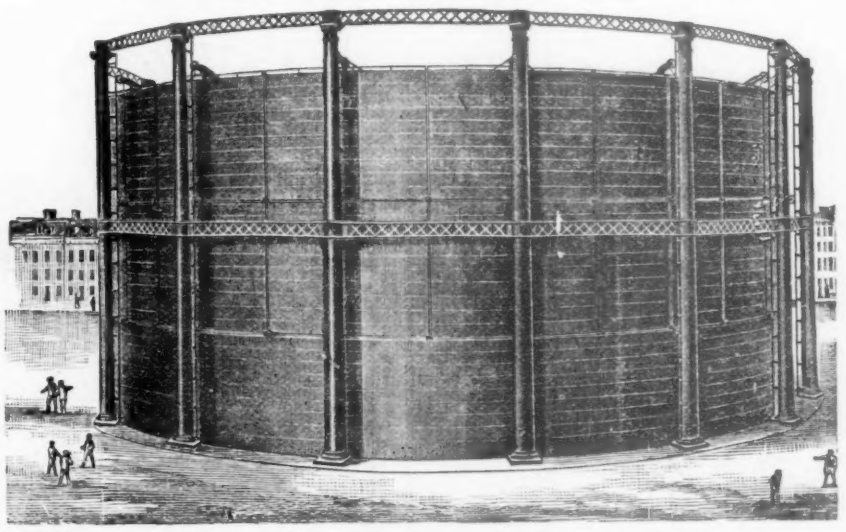

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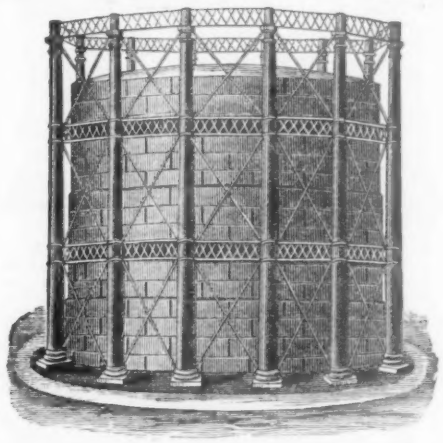

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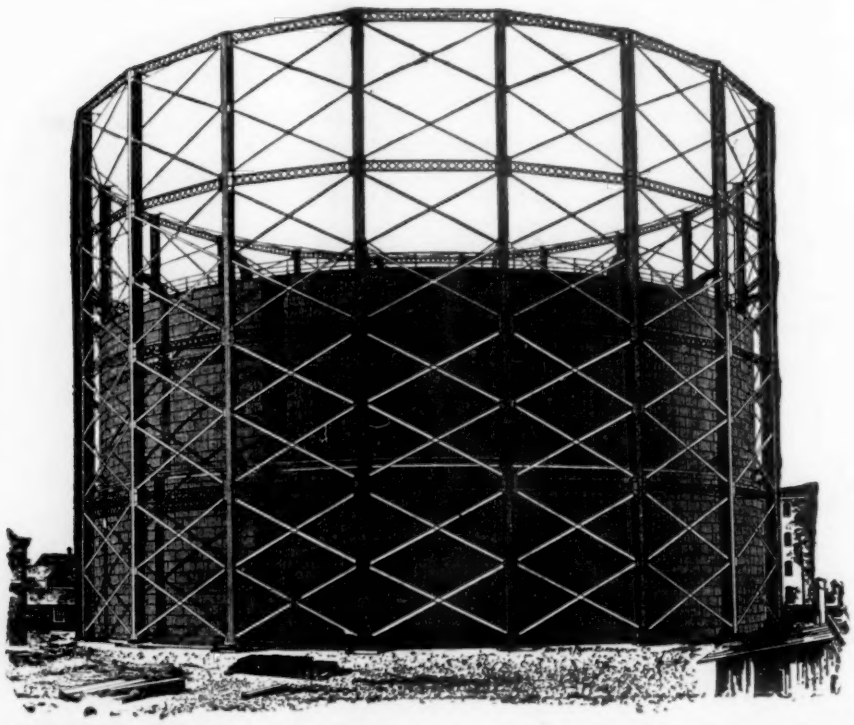

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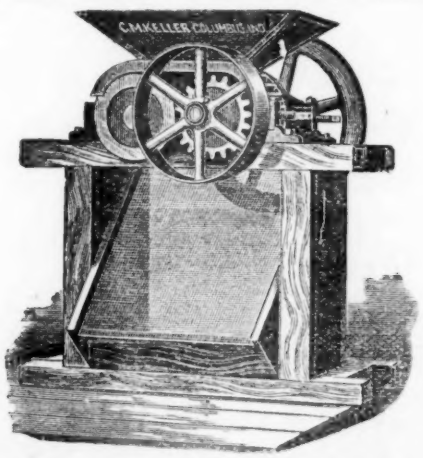

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	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1¼ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1¼ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

DRY and WET GAS METERS

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

METER PROVERS (Sizes 2, 5 and 10 feet.)

Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

DRY & WET CENTER SEALS, DRY & WET GOVERNORS, EXHAUSTER GOVERNORS.

Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus Complete.

Also, TESTING AND CHEMICAL APPARATUS OF ALL KINDS, AND OF THE MOST PERFECT DESCRIPTION, FOR ALL PURPOSES RELATING TO GAS.

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